2016

Denver Fire Engineer Examination

Study Material for Written Test
284 Pages
(Excluding Cover)
Section A

Denver Fire
Department Directives
PURPOSE: To establish a consistent review of DFD vehicle accidents

SCOPE: Applies to all members driving Department vehicles

DEFINITIONS: None

Accident Classification:

  Non-preventable – 0 points

Preventable – 0 to 12 points, taking into consideration the circumstances surrounding the accident and recommendation from the Police Department. Traffic violations will be assessed that number of points similar with the penalty point schedule in state statutes and used by the State of Colorado Motor Vehicle Division.

In order to maintain a valid DFD driver/operator license, a member shall not accrue more than 12 points within any twelve consecutive months or more than 18 points within any twenty-four consecutive months.

Primary Cause: Additional point assessment where there is a violation of Department Emergency Driving Policy – up to 6 points

If the accident is found to be non-preventable, the Department Driving Coordinator will forward the completed Denver Fire Department Form FD 402 to the Division Chief of Safety and Training. No points will be assessed.

If the accident is found to be preventable, the Division Chief or his/her designee will apply the total of preventable points plus primary cause points (if applicable) to the driver’s record and determine the level of discipline following the Denver Fire Department Disciplinary Guidebook (106.01).

Accrued points for only one accident could subject the driver/operator to disciplinary procedure without regard to any time limits.

NOTE: Discipline given for driving matters is subject to the same rules for representation and appeal as discipline levied for any other reason.

Points assessed for the current accident will be added to the points assessed during the past twenty-four consecutive months.
Accidents Outside of the City of Denver:

Accidents occurring outside the City of Denver shall be handled as above. The Department driver is still responsible for completing an accident packet and for completing the exchange of information with the other driver(s). It will be helpful to get information as to how to obtain a copy of the official report of the accident from the Police Officer of the jurisdiction in which the accident occurred.

Drivers who have been involved in either preventable or non-preventable accidents may be required to complete assigned JPRs if the Department Driving Coordinator believes that a driver/operator would benefit from such training and one of the following situations exists:

1. Three non-preventable accidents within an 18-month period
2. Any accident resulting in death or serious injury
3. Any vehicle accident that includes circumstances that indicate there would be a benefit to the member or the Department

Flagrant violations, extreme damage, and/or injuries may result in severe disciplinary recommendations.

Driver training shall be provided by the Department and may include defensive driving or emergency driving and maneuvering.

Questions concerning this policy may be directed to the Department Driving Coordinator at 720-865-4096 or to the Division Chief of Safety and Training at 720-865-3952.

REFERENCES: None
Purpose: It is the intent of this Driver Safety Program to allow the Department, the Department Driving Coordinator, and the Safety and Training Division greater control in the management of Fire Department driving issues.

The benefits of this program are:

1. Strict accountability for the operation of Fire Department vehicles.
2. Greater traffic safety for citizens and Department personnel.
3. Enhance the abilities of promoted driver/operators and acting driver/operators to operate Department vehicles safely and effectively.

*Colorado Revised Statutes (CRS) Title 42, ‘Vehicles and Traffic’, shall be used for the assessment of points and shall apply to all emergency and non-emergency driving violations and to violations of the Department code 10 policy.*

No Department member shall be authorized to operate any emergency vehicle without having first completed the Denver Fire Department Driver Safety Program.

The Driver Safety Program shall include obtaining a Denver Fire Department Driver’s License for emergency vehicles. The requirements for obtaining the Denver Fire Department License shall include, but are not limited to, the following:

- Possessing a *valid* Colorado State Driver’s License. Restrictions on a member’s Colorado Driver’s License shall prevail when certification is considered by the Driving Coordinator.
- 3rd grade Firefighter rank or greater.
- Successful completion of *all* steps required by the Department Driver Safety Program.

**NOTE:** The Department Driving Coordinator operates under the authority of the Division Chief of Safety and Training.

Company officers are free to consult with the Department Driving Coordinator about participation of company members in the Driver Safety Program.

Any Member whose position requires them to operate Denver Fire Department vehicles shall be required to obtain a Denver Fire Department license in order to do so.
There are six classifications of Fire Department licenses. Licenses for each specific vehicle allow members to drive only those that are included on that license. Exception: Members qualified on Quints may also drive/operate either an Engine or a Truck.

Class 1 - Light vehicles (Car, Pickup, Van, Civil Defense Rig, Air / Light Truck, Stake Bed Trucks, and Warehouse Vehicles).

Class 1 licenses may be issued to any Department member who holds a valid Colorado State Driver’s License. Members operating specialized vehicles (i.e. Air / Light Truck) shall complete training in the operation of that specialized equipment. Class 1 also includes: (a) Non-emergency vehicles where the member has not completed the Driver’s Safety Program regardless of rank and (b) Emergency vehicles where the member has completed the Driver’s Safety Program and has attained the rank of 3rd Grade Firefighter or greater.

Class 2 – Engine, Midi, Squirt and Rescue

Class 3 – Aerial Truck, Dump Truck

Class 4 – Tower, Quint

Class AS- All-Steer Vehicles (includes towers where specialized training is required)

Class X – Crash Fire Rescue Apparatus

The license classes described above may be modified where appropriate and additional license classes may be added as new types of apparatus become available and are added to the Denver Fire Department fleet.

Any member found to be driving a Fire Department vehicle with a suspended Colorado State Driver’s License or a suspended Denver Fire Department License will be in violation of Department policy, and will be subject to disciplinary action.
PROCEDURES FOR DFD VEHICLE AND APPARATUS ACCIDENTS

Whenever any vehicle or apparatus assigned to the Denver Fire Department is involved in a traffic accident, the incident will be classified by dispatchers as an “Accident-Fire Dept. Vehicle” or “Accident-Fire Dept. Apparatus.” All accidents involving DFD vehicles or apparatus shall be reported and investigated and the accident packet shall be fully completed. All accidents occurring off Department property will require a police response. The following procedures shall be followed in the event a Department vehicle or apparatus is involved in an accident. All Fire Department vehicles and apparatus shall carry a complete Accident Packet. It shall be the responsibility of the officer in charge and/or the driver/operator to complete all required actions and forms and to make sure forms are available in the vehicle. Forms are available online on the Department’s website (Downloadable Forms / Administration / Accident Packet).

DO NOT MAKE STATEMENTS REGARDING THE ACCIDENT TO ANYONE EXCEPT POLICE OR DEPARTMENT INVESTIGATORS.

I. PROCEDURES FOR ACCIDENTS INVOLVING ALL FIRE DEPARTMENT VEHICLES, INCLUDING FIRE APPARATUS

A. All vehicles and apparatus involved in an accident, including apparatus responding on emergency responses, must stop immediately, render aid as needed, and begin the reporting procedure.

B. Notify the dispatcher immediately of the following:
   1. Dept. vehicle or apparatus involved
   2. Location
   3. Need for a cover-in company (for responding apparatus)

C. Request the following:
   1. DFD Fire Company (If additional DFD resources are needed)
   2. Ambulance for injured parties (include details of injuries and the number of injured parties)
   3. Police (if determined by the investigating Chief that damage was NOT limited to Department vehicle)
   4. Activation of Accident Call List
   5. Opening of an Incident for the accident
DENVER FIRE DEPARTMENT

DEPARTMENT DIRECTIVE

Topic: Accidents Involving DFD Vehicles or Apparatus

6. Notification of District Chief, or if a Support Division vehicle, the Division Assistant Chief (during business hours) for investigation

D. Document the following:
   1. Name, age, and date of birth of all injured parties
   2. Address and phone numbers of all involved parties (work/cell if possible)
   3. Ambulance company name/s, number/s, and attendant name/s
   4. Hospital destination of all injured parties

E. Obtain and document:
   1. Name, address, and phone numbers for all involved drivers
   2. Driver’s license number for all involved drivers (copy the number from the license)
   3. License plate and VIN number from all vehicles involved
   4. Insurance company, policy number, agent, and agent telephone numbers - note expiration dates.

F. Obtain name, address, and phone number for each witness.

G. The investigating Assistant Chief or other Denver Fire Department investigator shall make certain that comprehensive photographs are taken of involved vehicles and the accident scene. (See photo guidelines in accident packet)

H. Include only known facts in written or verbal reports. Obtain statements from all parties and crew members present.

DO NOT MAKE CONCLUSIONS OR ASSUME LIABILITY FOR THE ACCIDENT.

I. Refer to Executive Order 94 for guidance in completing post incident testing.

J. All items in the Accident Packet shall be completed and returned to the Administration Division, through the Chain of Command, within 72 hours after an accident. Completed packets may be submitted electronically via the Administration
Division email address at: FireAdmin@denvergov.org. The completed packet should contain:

1. Completed Accident Packet checklist
2. Copy of the letter from the Company Officer (apparatus) or driver/operator (DFD vehicle) explaining the details of the accident, through the chain of command to the Chief of the Department
3. Accident Information Exchange Form(s)
4. Vehicle Accident Data Sheet
5. Driver/Operator Vehicle Accident Report
6. Letter from the Fire Department officer investigating the accident. All supervisory letters on accident investigations shall include whether or not Executive Order 94 was invoked, with reasons why or why not.
7. Photographs (may be emailed)
8. Witness statements and crew statements.

K. The Administration Division will notify the Deputy Chief and the appropriate Division Chief of all accidents involving their Division in a monthly report. After review of the accident documentation, the Administration Division will forward copies to the Chief of Department through the chain of command and initiate the review committee process as appropriate.

L. Complete NFIRS reports.

M. Accidents Outside of the City of Denver:

DFD Vehicle or Apparatus accidents occurring outside the City of Denver shall be handled as above. The Company Officer (apparatus) or driver/operator (DFD vehicle) is still responsible for completing an accident packet and for completing the exchange of information with the other driver(s). Company Officers or driver/operators should get information as to how to obtain a copy of the official report of the accident from the Police Officer of the jurisdiction in which the accident occurred.
II. REVIEW OF ACCIDENTS INVOLVING FIRE DEPARTMENT VEHICLES / APPARATUS AND PERSONNEL

All accidents involving fire apparatus shall be reported, investigated, and have a completed accident packet submitted. **No member shall investigate their own accident.**

A. The Assistant Chief of the involved Division and the on-duty member of the Administration Division staff shall be notified of **ALL** Fire Department vehicle accidents.

A member of the Administration Division and a member of the Safety and Training Division staff shall respond to **ALL** accidents where injury or death has occurred.

**Include all forms.** If a form is not applicable, mark with a large “N/A.”

B. The Administration Division will be responsible for notifying the Deputy Chief of the Department of all accidents.

C. The Administration Division will request a Review Board meeting through the Department Driving Coordinator. It shall be the duty of the Department Driver/Operator Safety Review Board to review all Department vehicle accidents. The Driver/Operator Safety Review Board shall, upon review of the incident, determine whether an accident was preventable or non-preventable and determine a primary cause when necessary.

1. **Preventable:** Accident was principally caused by driving actions in violation of traffic laws and/or Department policy
2. **Non-preventable:** Unavoidable accident; proper defensive techniques were practiced.
3. The DFD Driver/Operator Safety Board will present its recommendations to the Administration Division Chief for determination of points or disciplinary measures to be assessed and any recommendations of remedial training to the Safety and Training Division.
4. When the consideration of the accident is complete, the Administration Division shall record the findings. Point values are determined as follows:

III. FIRE DEPARTMENT VEHICLE / APPARATUS ACCIDENT CLASSIFICATION

Non-preventable – 0 points, accidents determined to be unavoidable with reasonable preventive measures and actions consistent with Department driver training.

Preventable – 0 to 12 points, taking into consideration the circumstances surrounding the accident and report information from the Police Department. Traffic violations will be assessed that number of points similar with the penalty point schedule in state statutes and used by the State of Colorado Motor Vehicle Division.

In order to maintain a valid DFD driver/operator license, a member shall not accrue more than 12 points within any twelve consecutive months or more than 18 points within any twenty-four consecutive months.

Primary Cause: Additional point assessment where there is a violation of any Department driving policy

If the accident is found to be non-preventable, the Administration Division will file a document in the Department Driving Records, with a copy to the operator’s Division Chief. No points will be assessed.

If the accident is found to be preventable, the total of preventable points plus primary cause points (if applicable) will be applied to the driver’s record and a determination of discipline (if applicable) will be initiated by the operator’s supervisor according to the Department disciplinary process (see NOTE below).

Accrued points for only one accident could subject the driver/operator to disciplinary procedure without regard to any time limits.

NOTE: Discipline given for driving matters is subject to the same rules for representation and appeal as discipline levied for any other reason.

Points assessed for the current accident will be added to the points assessed during the past twenty-four consecutive months.
Drivers who have been involved in either preventable or non-preventable accidents may be required to complete assigned JPRs if the Department Driving Coordinator believes that a driver/operator would benefit from such training and one of the following situations exists:

1. Three non-preventable accidents within an 18-month period
2. Any accident resulting in death or serious injury
3. Any vehicle accident that includes circumstances that indicate there would be a benefit to the member or the Department

Flagrant Violations: Violations that contradict other Department standards or result in extreme damage and/or injuries may result in severe disciplinary recommendations.

Driver training shall be provided by the Department and may include defensive driving or emergency driving and maneuvering.

Questions concerning this policy may be directed to the Administration Division.

Point assessment values will correlate with the following corrective actions:

- 0 – 3 points: Company Level Training
- 4 - 7 points: Verbal Reprimand and Company Level Training
- 8 – 9 points: Written Reprimand
- 10 points: Written Reprimand and the Denver Police Department Emergency Vehicle Operation Course E.V.O.C.
- 12 or more points: Suspension of Denver Fire Department driver’s license, possible reassignment, and appropriate disciplinary action which may include suspension, demotion, or termination
Drivers or Company/Chief Officers shall report vehicle accidents they are NOT involved in by:

1. Contacting the Dispatcher and reporting the accident. The driver or officer should state that his/her vehicle is not involved.

2. Giving the accident location and requesting Police. Where applicable, ask for an ambulance response – giving as many details about number of injured parties and type of injuries as possible.

3. Informing the Dispatcher if the driver or crew is giving assistance at the scene. Request additional apparatus as needed – giving details about what type of assistance is required - i.e. fire, extrication, hazard removal, sand, hazardous materials, etc.
The following procedure shall be followed for accidents involving Denver Fire Department Vehicles on Department property, with no other person or agency involved and with no injuries:

1. Notify Dispatcher if the accident has put you out of service, and request an incident number. *(Stay In Service if the above conditions exist and you are able to respond to an incident).*

2. Request that the Dispatcher initiate the Accident Call List and to send the District Chief/Supervisor/ Department Driving Coordinator or other investigator from Safety and Training.

3. Make certain that pictures are taken at accident scene by the District Chief or Fire Department investigator. *Refer to Accident Packet for Guidelines For Taking Photos.*

4. Send completed Accident Packet and film (or forward digital images) to Safety and Training Division within 24 hours for processing. A complete Accident Packet should include the following items:
   
   A) Accident packet checklist
   
   B) Copies of the letters to the Chief of the Department, by the Driver/Operator and Company Officer
   
   C) FD 402 – Vehicle Accident Data Sheet
   
   D) FD 403 – Driver/Operator Vehicle Accident Report
   
   E) Photographs
   
   F) Letter from investigating DFD Personnel

5. **Do not call for Police or other agencies unless there are injuries.**
MEMBER RESPONSIBILITIES –

A member shall notify his/her immediate supervisor and provide written notice to the Chief of the Department, through the member’s chain of command, immediately upon reporting to work for her/his next duty shift, following the occurrence of ANY of the following:

1. Suspension of their Colorado Driver’s License

2. Any new restriction on his/her Colorado Driver’s License

3. Any moving violation including from a Photo Radar unit (Members are reminded that most states share violation information with the State of Colorado)

Failure to report any of the above may subject a member to discipline.

The Department Driving Coordinator shall check the driver’s license of each Fire Department member annually through the Department of Motor Vehicles. By Executive Order, each member shall have a current ‘Permission for Release of Individual Records’ (DR 2559 07/03) on file with the Driving Coordinator.

When a member renews his/her Colorado Driver’s License, s/he shall forward the new license number and expiration date to the Driving Coordinator.

No Department member is authorized to operate a Department vehicle without possessing a valid Colorado State Driver’s License. (A member who is issued a provisional driver’s license to drive his/her vehicle to and from his/her home to the workplace shall not be permitted to operate any Department vehicle until his/her regular driving privileges are reinstated and a regular driver’s license reissued.) No member is authorized to operate a Department emergency vehicle without having first completed the Driver’s Safety Program.

Any member driving a Department vehicle with a suspended driver’s license or a provisional driver’s license as described above is in violation of this policy and may be subject to discipline.
CODE 10 RESPONSES:

It is absolutely prohibited for any Fire Department vehicle to pass another vehicle that is responding Code 10 regardless of the response mode of the Fire Department vehicle, the destination of either vehicle, or the Agency of the other vehicle.

This policy shall be strictly adhered to by all DFD personnel to insure the safety of the citizens of the City and County of Denver and all emergency personnel.

Violation of this Code 10 response policy may subject the member to disciplinary action.
OVERVIEW:

The Department recognizes that seat belt use helps to protect our employees, reduce injuries, and control operating costs. Studies by several fire service organizations show conclusively that failure to use seat belts (lap and shoulder belts) results in increased deaths and injuries. Reducing these costly injuries and deaths protects our members and can strengthen our effectiveness as a Department. Therefore, we are mandating the following policy:

Seat belts shall be used at all times while driving or riding in any Department vehicle on company or personal business, or in any other vehicle while on official Department business. This policy applies to all Department members (Civil Service and Career Service) and all occupants of vehicle driven by Department members on official business. No Department vehicle shall be moved until the driver and all passengers are wearing seat belts.

EXCEPTIONS:

I. In accordance to CRS 42-4-237-3b, a member of an ambulance team, other than the driver, while involved in patient care, is exempt from wearing a seat belt.

II. Members of the Dive Team or Trucks having a “Gumby Suit” responding to a confirmed swift- or still-water rescue, and who are expected to don required PPE to perform an immediate life saving act upon arrival, will be exempt from this policy. This does not exempt any member not required to don safety equipment while en route to the scene. The apparatus driver will respond with extreme caution.

RESPONSIBILITIES:

All personnel will be held accountable for using seat belts. Non-compliance may result in disciplinary action. Officers and acting officers are responsible for ensuring that all Department members comply with this Directive and receive periodic reminders to use seat belts.

ACCOUNTABILITY:

Failure to comply will result in a 24-hour suspension in pay along with a fine to cover overtime costs, if overtime is necessitated to cover the position vacated by the
suspension, plus any other discipline deemed appropriate by the Chief of the Department.

OBJECTIVE:

Wearing a seat belt is one of the simplest and most effective ways to stay safe, yet many Department members may still not do it. When seat belts are not used, the potential for crash-related injuries and death increases dramatically. Crash-related injuries attributable to not wearing a seat belt can affect a Department member’s livelihood and can have a tremendous emotional and financial impact on the member’s family. Based on this, the Denver Fire Department administration, through this directive, is taking steps to protect all Department members by ensuring 100% compliance 100% of the time.
The Denver Fire Department is dedicated to:

- Providing quality, timely, and professional emergency services to those who live in, work in, and visit the City and County of Denver and the communities we serve.

- Respecting each other through trust, pride, diversity, integrity, and training.

- Working together to achieve the highest levels of preparedness, prevention, and community involvement with a dedication to purpose.
The following list of guidelines represents the conduct standards for members of the Denver Fire Department.

Every member of the Denver Fire Department is expected to conduct themselves in a self-disciplined and professional manner and is responsible for that conduct and should project a positive, productive, and mature demeanor.

EVERY MEMBER SHALL:

1. Comply with the Guidelines of their respective Divisions and written Directives of both the Denver Fire Department and the City of Denver.

2. Use their training and capabilities to protect the public at all times.

3. Work to the level of expertise in their position so as to enable all Department programs and functions to operate effectively.

4. Always conduct themselves to reflect credit on the Department and the City of Denver.

5. Supervisors will manage in an effective, considerate, and fair manner. Subordinates will follow instructions in a positive, cooperative manner.

6. Always conduct themselves in a manner that creates good order inside the Department.

7. Keep themselves informed to enhance their awareness and efficiency concerning their positions.

8. Be concerned and protective of each member’s welfare.


10. Use good judgment.

11. Keep themselves physically fit.

12. Observe the work hours of their position.
13. Obey the law.

14. Be responsible and maintain any/all Department equipment and property at an efficient and usable level.

**MEMBERS SHALL NOT:**

15. Engage in activity that is detrimental to the Department.

16. Engage in a conflict of interest to the department or use their position with the Department for personal gain or influence.

17. Use alcoholic beverages, debilitating drugs, or any substance which impairs their physical or mental capacities while on duty, or when susceptible to emergency recall.*

18. Engage in intimidating, threatening, or hostile behaviors, physical assault, or other acts of this nature.

19. Engage in any sexual activity while on duty.*

20. Abuse their Sick Leave.


22. Depart from the truth.*

*Members found to be in violation of these sections may be terminated.
It is the policy of the Denver Fire Department that sexual harassment is not acceptable and will not be tolerated. All employees are expected to avoid any participation in unwelcome behavior or conduct toward any other employee, which could be interpreted as sexual harassment under the following guidelines:

Section 703 of Title VII of the Civil Rights Act defines sexual harassment as follows:

Unwelcome sexual advances, requests for sexual favors, or other verbal or physical conduct of a physical nature, when:

1. Submission to such conduct is made either explicitly or implicitly a term for condition of an individual’s employment; or
2. Submission to or rejection of such conduct by an individual is used as the basis for employment decisions affecting such individuals; or
3. Such conduct has the purpose or effect of unreasonably interfering with an individual’s work performance or creating an intimidating, hostile, or offensive environment.

Examples of sexual harassment include, but are not limited to:

1. Sex-oriented verbal “kidding”/”jobbing.”
2. “Teasing” or joking that takes on a sexual tone.
3. Subtle pressure for sexual activity.
4. Physical contact such as patting, pinching, or constant brushing against another’s body.
5. Demands for sexual favors.
6. Printed material that is construed to be sexually offensive.
7. Television broadcasts or video tapes of a sexual nature.*

A supervisor or any other person is engaging in sexual harassment if they use, offer, or threaten to use the power of their office or position to control, influence, or affect the career, salary, or job of another employee or prospective employee in exchange for unwelcome sexual favors.
Any employee is engaging in sexual harassment if they participate in deliberate or repeated unsolicited verbal comments, gestures, or physical contact of a sexual nature which are unwelcome or interfere with work productivity.

The following procedures shall be followed when sexual harassment occurs:

1. The affected individual shall make it clear to all involved persons that such behavior is offensive to them.
2. The affected individual shall bring the matter to the appropriate supervisor’s attention.**
3. The supervisor shall investigate the complaint of sexual harassment promptly. The determination of whether or not a particular action constitutes sexual harassment shall be made from the facts on a case-by-case basis. In determining harassment, the supervisor or other appropriate official shall look at the totality of the circumstances, such as the nature of the sexual conduct and the context in which the alleged incidents occurred.
4. If sexual harassment is found to exist, appropriate management and supervisory personnel shall take prompt corrective action. Please refer to Topic #106.01, Disciplinary Guidebook, to ensure that correct procedures are followed.

- Sexual harassment, which has the effect of unreasonably interfering with an employee’s work performance or which creates an intimidating, hostile or offensive environment shall constitute a violation of the Department’s Conduct Standards, and may result in discipline up to and including dismissal on the first offense.
- Sexual harassment, which affects a term or condition of employment or which is the basis of an employment decision affecting the employee or prospective employee, shall constitute a violation of the Department’s Conduct Standards, and may result in discipline up to and including dismissal on the first offense.

5. If the actions of the immediate supervisors do not effectively stop the sexual harassment, the affected individual shall contact the EEOC Coordinator at the Human Resources Bureau. The complaint will then be further investigated and dealt with by that coordinator.
**DEPARTMENT DIRECTIVE**

**Topic No:** 1021.00  
**Date:** 07-10-15  
**Approved:** ECT  
**Review Date:** 07-10-17  
**Replaces:** Same, dated 01-03-12

**Topic:** Sexual Harassment Policy

Refer to department policy when using cable television or video tapes in the fire house.

The displaying of sexually explicit material in a public building and in the work environment is in violation of Section 703 of Title 7 of the Civil Rights Act. The fact that such material may create an intimidating work environment for some individuals is cause for prohibition.

*Company Officers and District chiefs will be held responsible for ensuring compliance of this policy.* Those who are found in violation of this policy will be dealt with in accordance with the sexual harassment policy of the Denver Fire Department.

*The broadcasting of sexual explicit material in any fire department facility is hereby prohibited.*

**Appropriate supervisor** can include immediate supervisor or anyone in the chain of command, EEO Officer of the Department (Administrative Division Chief, Division 4) or Employee Group Officer. It is the responsibility of the “appropriate supervisor” to report the allegation immediately to the administration at the Denver Fire Department Headquarters.
Pursuant to City Attorney Memorandum:

DATE: February 23, 2001

TO: Cathy A. Donohue, Public Works Manager
    Alan Ochsenbein, Denver International Airport

THROUGH: Xavier S. L. DuRan, Assistant City Attorney, Supervisor

SUBJECT: EXECUTIVE ORDER 94

"Per your request, I am providing further explanation as to the reason for the rewrite to Executive Order 94, the City and County of Denver Employees’ Alcohol and Drug Policy. As a reminder, the purpose of the rewrite was to: (a) ensure compliance with recent state and federal law and the new Department of Transportation regulations passed in December 2000; and (b) make the executive order more user friendly."

I. COMPLIANCE WITH STATE AND FEDERAL LAW

A. Section IB, Legal Drugs, 2: This section was rewritten in order to require return to work determinations while an employee is under the influence of prescription medication be made by the department’s Human Resource Specialist or Safety Officer only after consulting with medical personnel. This brings this section into compliance with state law and the Denver Health and Hospital Authority (“DHHA”) regulations. Additionally, this section was rewritten to require our medical providers acquire medical releases from employees prior to having conversations with the employees’ personal physicians, in accordance with DHHA regulations.

B. Section IB, Legal Drugs, 3: This language was rewritten in compliance with the new Department of Transportation regulations, which specifically prohibit employees with Commercial Drivers’ Licenses (“CDL”) from using marijuana, even though marijuana may have been approved for medical use under state law.

C. Section IIC, Post-Accident Testing, 1: This language was also rewritten in compliance with recent federal law. Specifically, it was altered to require that before any post-driving or workplace accident alcohol and drug tests are conducted, the department determine the employee involved in the accident may have been at fault and the accident involved a fatality, or any individual was injured enough to receive medical attention immediately away from the scene of the accident, or the accident resulted in disabling
damage to vehicle. Additionally, we added to this section the current definition of disabling damage.

II. USER FRIENDLY

The individuals who use this Order on a regular basis have continually complained to the Drug and Alcohol Committee about how difficult it is to follow the Executive Order. Therefore, in an attempt to make the Order more user friendly, we reorganized the paragraphs. Specifically, we moved all paragraphs concerning CDL testing into one section and all of the paragraphs discussing non-CDL testing into another section.

We also listed the supervisors’ duties from supplemental manuals in this Order, so the Order will now stand-alone. For example, under reasonable suspicion testing, section II. DRUG AND ALCOHOL TESTING, B1.a.i-viii, we listed each step that a supervisor must take when ordering this type of test.

Additionally, we included a section to allow for classified members of the Police and Fire Departments and Deputy Sheriffs to be tested in the future. As you may be well aware, the Manager of Safety, Aristedes Zavaras, in concert with my office, is currently developing Department of Safety regulations to provide for this testing. See Section II.F.

In the training section of the Order, we expanded the explanation as to the employees’ and supervisors’ responsibilities. Again, this rewrite was made to include information from supplemental manuals so the Order will now stand-alone. Additionally, in this section, we changed the expression “probation period” to “first year of employment” since Career Service Authority is eliminating the expression “probation period” from its personnel rules.

Throughout the regulation, we also changed the expression “Office of Employee Assistance” to the correct name of that agency, which is “Mayor’s Office of Employee Assistance.”

In Section B of the miscellaneous provision of the Order, we added the search language approved by the City Attorney to be used on posted notices.

Finally in the addendum, we grouped the paragraphs referring to alcohol under the first section and grouped the provisions dealing with illegal drugs under the second section.
III. CONCLUSION

The Drug and Alcohol Committee made these revisions to comply with state and federal law and the Department of Transportation regulations. Additionally, we revised the Order to make it easier for anyone to follow, since we have received numerous complaints over the years that the Order was confusing. Hopefully, this memorandum has adequately explained the revisions. However, if you should have any further questions regarding this Order or would like the drafters of the Order to attend any meetings, in anticipation of any questions that may arise, please contact me at 720-913-3107.

Thank you.

RCH/mv
Pursuant to EXECUTIVE ORDER NO. 94 Memorandum:

DATE:       March 15, 2001

TO:         All City Agencies

FROM:       Wellington E. Webb
            M A Y O R

SUBJECT:    CITY AND COUNTY OF DENVER EMPLOYEES' ALCOHOL AND DRUG POLICY

PURPOSE:    As an employer, the City and County of Denver (City) is required to adhere to various federal, state, local laws and regulations regarding alcohol and drug use. The City also has a vital interest in maintaining a safe, healthy and efficient environment for their employees and the public. Being under the influence of, subject to the effects of or impaired by alcohol or a drug on the job may pose serious safety and health risks to the user, the user’s co-workers and the public. Additionally, the possession, use or sale of an illegal drug in the workplace may pose an unacceptable risk to the safe, healthy and efficient operation of the City.

The City maintains the Mayor’s Office of Employee Assistant and provides Department of Safety psychologists who offer help to employees who seek assistance for alcohol or drug use and other personal or emotional problems.

RESPONSIBLE AUTHORITY (S): City Attorney

This executive order, effective on the above date, establishes and confirms the policy of the City concerning the problem of drug and alcohol use in the workplace. On the date it becomes effective, this executive order supersedes all previous enacted alcohol and drug executive orders.

ALCOHOL AND DRUG POLICY FOR
CITY AND COUNTY OF DENVER EMPLOYEES:

I.   PROHIBITIONS FOR ALL CITY EMPLOYEES INCLUDING CLASSIFIED MEMBERS OF THE POLICE AND FIRE DEPARTMENTS.
A. Alcohol

Employees are prohibited from consuming, being under the influence of, subject to the effects of the impaired by alcohol while performing City business, while driving a City vehicle or while on City property, unless the employee is not on duty and attending an officially sanctioned private function, e.g., and invitation only library reception.

The alcohol levels defined by the state legislature that may be amended from time to time for defining “under the influence of alcohol” and “impaired by alcohol” are adopted here for purposes of this executive order.

Employees holding Commercial Driver’s licenses (CDL) are subject to the alcohol levels defined by the Department of Transportation (DOT) regulations that may be amended from time to time for “under the influence” which are adopted here for purposes of this executive order.

Current alcohol level definitions are contained in the Addendum to this Order. If there is a conflict between the state legislature or the DOT regulation alcohol level definitions and the ones contained in the Addendum to this Order, the state legislature and DOT regulation definitions will take precedence.

B. Legal Drugs

1. It is the responsibility of the employees who work in positions operating vehicles or dangerous equipment or affecting the health or safety of co-workers or the public to advise their supervisors that they are taking prescription medication that may affect their performance.

2. Employees who work in positions operating vehicles or dangerous equipment or affecting the health or safety of co-workers or the public are prohibited from consuming, being under the influence of, subject to the effects of or impaired by legally obtained prescription drugs while performing City business, unless the following two determinations have been made:
a. It is determined by both the employee’s supervisor and either the employee’s Human Resource Specialist or Safety Officer after consulting with the Occupational Health and Safety Clinic (OHSC) personnel that the employee’s job performance will not be affected and that the employee does not pose a threat to their own safety.

b. It is determined by both the employee’s supervisor and either the employee’s Human Resource Specialist or Safety Officer after consulting with the OHSC personnel that the employee will not pose a threat to the safety of co-workers or the public, and the employee will not disrupt the efficient operation of the agency.

If appropriate, the OHSC personnel may contact the employee’s personal physician. Prior to making contact with the employee’s personal physician, the OHSC personnel should try to obtain a medical release from the employee.

Employees may be required to use sick leave, take a leave of absence or comply with other appropriate non-disciplinary actions determined by the appointing authority until the above determinations can be made.

The OHSC shall keep the medical records that disclose the identity of the legal drug confidential in accordance with state and federal laws. Release of this information should only occur after a determination has been made that the employee is using the drug illegally.

3. The DOT regulations prohibit employees with CDLs from using marijuana, even for approved medical reasons. If the federal and Colorado laws are in conflict on this issue, the federal law will take precedence. Therefore, a positive marijuana drug test will be treated as an illegal drug use for employees with CDLs, subjecting them to all rules contained herein for illegal drug use even if the marijuana has been prescribed for the employee by a physician for medical reasons.
C. Illegal Drugs

1. Employees are prohibited from consuming, being under the influence of, subject to the effects of or impaired by illegal drugs while performing City business, while driving a City vehicle or while on City property.

2. Employees are also prohibited from selling, purchasing, transferring or possessing an illegal drug.

As a part of official duties, illegal drugs may be handled, controlled and disposed of according to established department contraband procedures by classified members of the Police and Fire Departments or Denver Sheriff employees. However, it is grounds for immediate dismissal if classified members of the Police and Fire Departments or Denver Sheriff employees sell, purchase, transfer or possess illegal drugs at any time other than as a part of their official duties.

The illegal drug cut-off levels established by the DOT regulations, that may be amended from time to time, are adopted here for purposes of this executive order. Current illegal drug levels are contained in the Addendum to this Order. If there is a conflict between the DOT regulation, illegal drug levels and the ones contained in the Addendum to this Orders, the DOT regulation definition will take precedence.

II. DRUG AND ALCOHOL TESTING

A. Pre-Employment Testing

1. City may implement, with the City Attorney’s approval, pre-employment screening practices designed to prevent hiring individuals for job positions:

   a. whose use of illegal drugs may affect the public health or safety and

   b. whose use of alcohol or legal drugs indicates a potential for impaired or unsafe job performance where the public health or safety may be affected.
The Civil Service Commission, Career Service Authority, OHSC or interviewing agency shall inform a job applicant of these pre-employment screening practices prior to such screening.

2. Employees with CDLs, prior to the first time the employee performs a safety-sensitive function, shall be tested for controlled substances, pursuant to applicable DOT regulations as may be amended from time to time.

3. Refusal by an applicant to submit to a pre-employment test shall result in denial of employment.

4. Pre-employment test results:

   a. **Alcohol**

      Where alcohol use is detected and it is determined to be a potential safety risk, employment shall be denied.

   b. **Legal Drugs**

      i. Where use of a prescription drug is detected, applicants may be required to offer proof that the drug has been prescribed by a physician for the applicant. If the applicant is unable to provide such proof, employment may be denied.

      ii. Where the applicant’s future or continued use of the drug poses a potential safety risk or would impair job performance, employment may be denied in accordance with the applicable state and federal laws.

   c. **Illegal Drugs**

      i. Employment shall be denied when the presence of an illegal drug is detected.

      ii. Employment shall be denied when the presence of a known masking agent is detected.
iii. A second direct observation urinalysis test may be required prior to offering employment to an applicant whose drug test evidences the urine sample has been diluted.

B. Reasonable Suspicion Testing

1. When a supervisor has reasonable suspicion that any employee is in violation of this policy, after taking appropriate safety measures, i.e., removing the employee from any situation which may pose a safety risk to the employee, co-workers or the public, the supervisor shall immediately consult with his/her Human Resources Specialist, Safety Officer or the City Attorney’s Office to determine further actions. However, if immediate consultation is not possible, it is the responsibility of the supervisor to initiate alcohol and drug testing. The supervisor shall initiate testing as follows:

   a. Alcohol

      i. Document in writing the specific reasons for the decision to initiate testing based on specific, contemporaneous, articulable observations of the employee’s appearance, behavior, speech or body odors.

      ii. Have a second supervisor confirm the specific, contemporaneous, articulable observations of the employee’s appearance, behavior, speech or body odors.

      iii. Confront the employee and articulate that the supervisor is ordering the employee to go to the testing site for testing.

      iv. Escort the employee to the testing site as soon as possible. However, if the supervisor is unable to escort the employee, the supervisor should have another individual escort the employee for testing. The individual selected to escort the employee shall
be of a higher grade/rank than the employee being tested.

v. Require the employee to bring a picture identification card and proof of the employee’s social security number to the testing site.

vi. If the employee refuses to go to the testing site or refuses to participate in the testing process, the supervisor or the escort should tell the employee that refusal to comply with a direct order of an authorized supervisor might subject the employee to discipline, up to and including dismissal.

vii. After the initial test results are known, the supervisor shall contact the appointing authority for further guidance. If the appointing authority is unavailable and the supervisor has a reasonable doubt about the employee’s ability to satisfactorily and safely meet job requirements, the supervisor shall place the employee on investigatory leave pending results of testing or other administrative determination.

viii. No supervisor or escort should allow an employee to drive to or away from the testing or the work site. However, if the employee does drive off, notify the Police Department immediately and provide them pertinent information, i.e., employee’s car make; model and color; license plate number, direction of travel and reason for ordering the alcohol and/or drug testing.

During regular OHSC hours, the testing shall be conducted at one of the OHSC testing site. After regular hours, the supervisor shall page the OHSC alcohol and drug testing personnel to arrange for immediate testing.

Testing should be administered within two (2) hours of making a reasonable suspicion determination. If this two (2) hour time frame is exceeded, the supervisor should document the reasons the test was not promptly administered. Supervisors who do not test employees within this established time frame may be subject to discipline, up to and including dismissal.
Supervisors and escorts shall keep the employee’s name and identifying information restricted to persons who “need to know.”

b. Legal drugs

i. Document in writing the specific, contemporaneous, articulable observations of the employee’s appearance, behavior, speech or body odors that provides reasonable suspicion that the employee’s use of or being under the influence of, subject to the effects of or impaired by a legal drug poses a potential safety risk or would impair job performance.

ii. Have a second supervisor confirm the specific, contemporaneous, articulable observations of the employee’s appearance, behavior, speech or body odors.

iii. Confront the employee and articulate that the supervisor is ordering the employee to go to the OHSC for evaluation.

iv. Escort the employee to the evaluation site as soon as possible. However, if the supervisor is unable to escort the employee, the supervisor should have another individual escort the employee for evaluation.

v. If the employee refuses to go to the evaluation site, the supervisor or the escort should tell the employee that refusal to comply with a direct order of an authorized supervisor might subject the employee to discipline, up to and including dismissal.

vi. If the clinic personnel determine that the employee’s use of, being under the influence of, subject to the effects of or impaired by a legal drug poses a potential safety risk or would impair job performance; the supervisor shall contact the appointing authority for further guidance.

vii. If the appointing authority is unavailable and the supervisor has a reasonable doubt about the employee’s ability to satisfactorily and safely meet job requirements, the supervisor shall place the employee on investigatory leave pending such consultation. However, no supervisor or escort should allow an employee to drive to or away from the evaluation site. If the employee does drive off, the supervisor or escort shall notify the Police Department immediately and provide them pertinent
information, i.e., employee’s car make; model and color; license plate number, direction of travel; and reason for ordering the evaluation.

viii. If the clinic personnel determine that the employee’s use of, being under the influence of, subject to the effects of or impaired by a legal drug does not pose a potential safety risk and does not impair job performance, have the employee return to work.

b. Illegal drugs

Follow the steps listed above in Section B.1.a.

However, testing for illegal drugs should be administered within eight (8) hours of making a reasonable suspicion determination. If this eight-hour (8) time frame is exceeded, the supervisor must document the reasons the test was not promptly administered. Supervisors who do not test employees within the established time frame may be subject to discipline, up to and including dismissal.

The police are to be contacted when a supervisor has reasonable suspicion that an employee appears to be in possession of, selling or transferring illegal drugs.

C. Post-Accident Testing

1. As soon as practicable following a driving or other workplace accident, the supervisor shall ensure that driver-employee is tested for alcohol and drugs when the accident:

   a. may have been the fault of the employee and the accident involves a fatality;

   b. may have been the fault of the employee and any individual was injured severely enough to receive medical treatment immediately away from the scene of the accident;

   c. may have been the fault of the employee and the accident resulted in disabling damage to any vehicle or any equipment; or,

   d. there is reasonable suspicion to test the employee.
2. Post-accident alcohol and drug testing should be administered within two (2) hours following the accident. Supervisors who do not test employees within the established time frames may be subject to discipline, up to and including dismissal.

3. “Disabling damage” for a vehicle accident is defined as precluding the departure of the vehicle from the scene of an accident in its usual manner. Vehicle damage that can be remedied temporarily at the scene without special tools or parts, i.e., replacing a tire with the spare, taping over a headlight or tying down the hood of a car, are not considered disabling.

4. “Disabling damage” for a workplace accident is defined as precluding the use of the equipment from its usual operation. Equipment that can be remedied temporarily at the scene without special tools or parts is not considered disabling.

D. Return to Duty Testing

1. If an employee has violated the prohibited conduct listed in Sections I(A) or I(C) of this Order, the employee shall not return to work unless the employee has completed a successful return to duty alcohol test.

E. Commercial Driver’s License Testing

For those positions requiring a CDL, the City shall implement drug testing pursuant to applicable DOT regulations, as may be amended from time to time in addition to the testing described in Sections I(B), I(C) and I(D) of this Order.

1. Pre-Employment Testing

Prior to the first time a driver performs safety-sensitive functions for the City or any of its agencies, the driver shall be tested for illegal drugs usage in compliance with the DOT and state regulations, as may be amended from time to time.

2. Reasonable Suspicion Testing

a. Alcohol
b. Legal Drugs

The procedures described in Section II(B)(1)(b) of this Order shall be followed.

b. Illegal Drugs

The procedures described in Section II(B)(1)(c) of this Order shall be followed.

3. Post-Accident Testing

a. As soon as practicable following an accident, the supervisor shall ensure that driver-employee is tested for alcohol and drugs when:

i. the accident occurred while the vehicle driver was performing safety-sensitive functions with respect to the vehicle and the accident involved the loss of human life;

ii. the vehicle driver was cited under the state or local law for a moving violation arising from the accident and an individual was injured severely enough to receive medical treatment immediately away from the scene;

iii. the vehicle driver was cited under the state or local law for a moving violation arising from the accident and one or more of the vehicles involved in the accident sustained disabling damage. “Disabling damage” is defined in Section II (C)(2) and (3) in this Order;

iv. there is reasonable suspicion to test the employee.

b. If the supervisor does not initiate alcohol testing with eight (8) hours of the accident or drug testing within thirty-two (32) hours of the accident, the supervisor shall cease attempts to administer the tests and shall state in writing for the record the reasons for not administering the tests. Supervisors who do not test employees
within the established time frames may be subject to discipline, up
to and including dismissal.

4. Random Testing

a. Alcohol

Pursuant to the DOT regulations, random alcohol testing shall be
conducted annually on 25% of the average number of City commercial
driver’s license positions in existence. This percentage may be amended
from time to time by the DOT. Alcohol testing shall be conducted on a
random, unannounced basis just before, during or just after the employee
performed safety-sensitive function.

b. Illegal Drugs

Pursuant to the DOT regulations, random drug testing shall be conducted
annually on 50% of the average number of City commercial driver’s
license positions in existence. This percentage may be amended from time
to time by the DOT. Drug testing shall be conducted on a random,
unannounced basis. There is no requirement that this testing be conducted
in immediate time proximity to performing safety-sensitive functions.

5. Return to Duty Testing

a. Alcohol

If an employee has violated the prohibited conduct listed in Sections I(A)
or I(C) of this Order, the employee shall not return to perform safety-
sensitive duties unless the employee has completed a successful return to
duty alcohol test.

6. Follow-Up Testing

a. Alcohol

i. The number and frequency of the follow-up alcohol tests shall be
directed by the substance abuse professional and shall consist of at
least six (6) tests in the first twelve (12) months following the
employee’s return to work.
ii. Follow-up testing shall be unannounced and shall be conducted just before, during or just after the employee performed safety-sensitive functions.

b. Illegal Drugs

i. The number and frequency of the follow-up drug tests shall be directed by the Substance Abuse Professional and shall consist of at least six (6) tests in the first (12) twelve months following the employee’s return to work.

ii. Follow-up testing shall be unannounced. There is no requirement that this testing be conducted in immediate time proximity to performing safety-sensitive functions.

F. Classified Members of the Police and Fire Departments and Deputy Sheriffs Testing

For those employees who are classified members of the Police and Fire Departments or Deputy Sheriffs, the City may implement drug testing pursuant to their respective department procedures, as may be amended from time to time in addition to the testing described in Section II (A), II (B), II(C) and II (D) of this Order.

III. EXECUTIVE ORDER 94 TRAINING

A. All City Employees

All new City employees should be trained on this Order during their first year of employment. Training, at a minimum, should include study of Order and instruction on the recognition of drug and alcohol impairment and use. Additionally, a copy of this Order should be given to each employee with employee acknowledging, in writing, receipt of the policy and the training.

B. All Employees with Supervisory Duties

1. All employees with supervisory duties should be trained on this Order during the first six months following their promotion. This training at a minimum should include study of the Order, instruction on the recognition of drug and alcohol impairment and use, the proper documentation of the
supervisor’s reasonable suspicion, and the supervisor’s responsibility for escorting employees to the testing sites and the drug testing process.

2. Supervisors shall ensure that all drug and alcohol tests are accomplished immediately after the justification for testing is established. Timeliness for testing is outlined in this Order and its Addendum. Further, once a supervisor has reasonable suspicion that an employee appears to be under the influence of alcohol or drugs, the agency cannot condone the employee’s driving of a motor vehicle. If the employee drives off in his/her own or a City vehicle, the Police Department must be notified immediately. Supervisors whom elicit the use on another individual to escort an employee to testing or evaluation sites shall educate the individual to escort an employee to testing or evaluation sites shall educate the individual on the duties of the escort as provided herein prior to allowing that individual to escort the employee.

3. Supervisors are subject to discipline for failing to fulfill the responsibilities set forth for supervisors in this Order. However, although a supervisor’s failure to fulfill his/her responsibility may result in disciplinary action being taken against the supervisor, up to and including dismissal, such failure does not, in any way, excuse the employee’s violation of this Order or negate the agency’s disciplinary action against the employee.

**CAUTION:** No physical force may be used against an employee to enforce any order under this policy. The employee must be advised that noncompliance with a supervisor’s order will be viewed as refusal to obey the order of a supervisor and subject to discipline, up to and including dismissal.

**CAUTION:** Supervisors are to restrict communications concerning possible violations of this policy to those persons who are participating in the evaluation, investigation or disciplinary action and who have a “need to know” about the details of the drug/alcohol evaluation, investigation and disciplinary action. This restriction includes not mentioning the names of employees who are suspected of or disciplined for violating this policy.
IV. DISCIPLINARY ACTIONS

A. If it is determined after the appropriate pre-disciplinary meeting that any of the following situations apply, the employee shall be dismissed even for the first offense for the following conduct.

1. Classified members of the Police and Fire Departments or Deputy Sheriffs violate their respective departments’ prohibitions regarding illegal use of controlled substances;

2. The employee has endangered the lives of others, or foreseeably could have endangered the lives of others;

3. The employee’s disciplinary history compels dismissal as a matter of progressive discipline;

4. The employee has refused to enter into a Stipulation and Agreement;

5. The employee has violated the Stipulation and Agreement;

6. The employee refuses to submit to testing under this Order;

7. The employee uses, or attempts to use, a masking agent to alter the sample and/or drug and/or alcohol test results.

B. A first time violation of this policy, which does not result in a dismissal pursuant to Section (A) of this Order, shall result in a lesser disciplinary action in conjunction with a Stipulation and Agreement for treatment.

1. Substance Abuse Professionals of the Mayor’s Office of Employee Assistance, or such other substance abuse professional(s) as may be designated, shall conduct an assessment of the employee and create a treatment plan.

2. Each such agreement shall be in writing and approved by the City Attorney’s Office. The City shall offer no employee more than one such agreement during his or her employment with the City.

3. Employees who participate in a supervisor-approved inpatient treatment plan shall be allowed to take one (1) day per month sick leave or vacation leave, or allowed to work one (1) day per month, to assure continued health coverage.
### V. MISSCELLANEOUS PROVISIONS

#### A. Driver’s License

It is the responsibility of employees required to drive as part of their assigned duties or job specifications to report to their appointing authority any loss of a driver’s license or the restriction of driving privileges, no later than the beginning of the employee’s next scheduled shift. Every employee who is required to drive, as part of their assigned duties or job specifications, shall certify that they have a current valid drivers license in accordance with Executive Order 25 as may be amended from time to time.

#### B. Searches

1. Before any search is conducted, supervisors shall contact the City Attorney’s Office for guidance.

2. Management has the right to search City-owned property, e.g., a desk, storage cabinet or City vehicle, when the search is necessary for a non-investigatory work-related purpose such as retrieving a needed file. Additionally, management may search City-owned property, e.g., a desk, file cabinet, locker, or City vehicle, when predicated by reasonable suspicion that evidence of misconduct will be found. Finally, management may search an employee’s personal property, e.g., their personal vehicle parked on City property, lunch boxes, briefcases, purses, tool kits, and backpacks, upon consent of the employee.

3. Clearly posted notices explaining the City’s right to carry out search activities should be displayed in appropriate locations throughout the work area. The posted notices should contain the language listed above in paragraph V (B)(2) of this Order. Any deviation from this language must be approved by the City Attorney’s Office prior to posting.

#### C. Contracts

1. This Executive Order is applicable to contract personnel. Violation of these provisions or refusal to cooperate with implementation of
the policy can result in the City; barring contract personnel from City facilities or from participating in City operations.

2. All City contracts shall inform contractors doing work for the City about this Executive Order.

D. Mayor’s Office of Employee Assistance and Department of Safety Psychologists

The City maintains the Mayor’s Office of Employee Assistance (MOEA) and provides Department of Safety psychologists who offer help to employees who suffer from alcohol or drug use of other personal issues. It is the responsibility of each employee to seek help from the MOEA, Department of Safety psychologist or other appropriate health care professionals before alcohol and drug use leads to disciplinary actions.

E. Memorandum to this Order

The City Attorney shall have the authority to amend definitions and drug testing cut-off levels contained in the Order’s Memorandum, from time to time, consistent with Colorado statues and the DOT regulations, without obtaining signatures of the Mayor or City Council. For purposes of this Executive Order, all references to Agency head, Department head or appointing authority will also include the designee of the Agency head, Department head or appointing authority.
DENVER FIRE DEPARTMENT

DEPARTMENT DIRECTIVE

Topic: Executive Order 94 – City and County of Denver Employees’ Alcohol and Drug Policy

Approved for Legality:

J. Wallace Wortham, Jr.
City Attorney

Approved:

Wellington E. Webb
MAYOR

Bruce Baumgartner
Manager of Aviation

Theresa M. Donahue
Manager of Environmental Health

Thomas J. Migaki
Manager of General Services

Betty Jean Brooks
Manager of Parks & Recreation

Stephanie Foote
Manager of Public Works

Cheryl D. Cohen
Manager of Revenue

Aristedes W. Zavaras
Manager of Safety

Dr. Chris Veasey
Manager of Human Services
MEMORANDUM NO. 94A

TO: All Agencies Under the Mayor

FROM: Wellington E. Webb
Mayo

DATE: March 15, 2001

SUBJECT: STATUTORY PROVISIONS

This memorandum to Executive Order 94 was originally referred to as an addendum, effective April 10, 1989, amended April 13, 1999, January 10, 2000 and March 1, 2000 and is hereby continued in effect as amended and retitled as a memorandum this March 15, 2001. This Memorandum shall be attached to and become a part of Executive Order 94, dated, March 15, 2001, subject “City and County of Denver Employees’ Alcohol and Drug Policy.”

I. ALCOHOL PROVISIONS

A. Under the Colorado statutes, as may be amended from time to time, “impaired by alcohol” is defined as having 0.05 grams of alcohol (per two hundred ten liters of breath or per one hundred milliliters of blood), but less than 0.10 grams of alcohol. Under the “influence of alcohol” is defined as having 0.10 or more grams of alcohol (per two hundred ten liters of breath or per one hundred milliliters of blood).

B. Under the DOT regulations, as may be amended from time to time, “under the influence of alcohol” is defined as having 0.04 percent alcohol concentration, or more; as prescribed by state law; or in the event of refusal to undergo such testing as is required by the state or jurisdiction.
DOT regulations, as may be amended from time to time, state that post-accident alcohol testing should be administered within two (2) hours following the accident, but must be administered within eight (8) hours following the accident. **These DOT time frames shall also apply to testing under this Executive Order unless otherwise specified within this Order.**

II. **ILLEGAL DRUG PROVISIONS**

A. Illegal drugs, including controlled substances, are defined in Colorado Revised Statutes §12-22-303.

B. “Subject to the effects of an illegal drug” is to be determined consistent with the confirmation test levels established by the DOT regulations, as may be amended from time to time:

- Marijuana metabolites: 15ng
- Cocaine metabolite: 150ng
- Opiates:
  - Morphine: 2,000ng
  - Codeine: 2,000ng
  - Phencyclidine: 25ng
- Amphetamines:
  - Amphetamine: 500ng
  - Methamphetamine: 500ng

Drug testing shall be administered no later than thirty-two (32) hours after the accident. **These DOT time frames shall also apply to testing under the Executive Order unless otherwise specified within this Order.**
EXECUTIVE SUMMARY OF CHANGES

Executive Order No. 94

TITLE: City and County of Denver Employees’ Alcohol and Drug Policy

CURRENT DATE: March 1, 2000

PROPOSED REVISION: March 15, 2001

REASON FOR CHANGES:

The existing Executive Order that established policy and procedures regarding alcohol and drugs was last revised in March 1, 2000. Several federal law and court cases necessitated the re-write.

MAJOR CHANGES:

See Memorandum from City Attorney R. Craig Hess for specific changes.
When a Fire Department member voluntarily seeks aid for a drug or alcohol problem from the Fire Department Psychologist, that transaction shall be deemed confidential. If the department member voluntarily enters appropriate treatment for drug/alcohol problems as recommended by the Department Psychologist or other appropriate professional health service provider, there shall be no action taken detrimental to the member’s job by department management on that occasion.

This policy is intended to apply only to those situations where a member’s conduct, due to drug or alcohol abuse, has not already become a problem for the Department. When the member’s conduct has already become a problem, the Chief of Department must have his usual discretionary powers. Subsequent problems with drug/alcohol abuse by the same member shall be dealt with in the usual manner, namely, on a case-by-case basis at the discretion of the Chief of Department.

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**Policy Overview**

As an employer, the City is required to adhere to various federal, state, and local laws and regulations regarding alcohol or drug abuse. These laws are contained in the attached appendix.

The City also has a vital interest in maintaining safe, healthy, and efficient working conditions for its employees. Being under the influence of a drug or alcohol on the job may pose serious safety and health risks not only to the user but to all those who work with the user. The possession, use or sale of an illegal drug or use of alcohol in the workplace may also pose unacceptable risks for safe, healthful, and efficient operations.

The City also maintains an Office of Employee Assistance and provides Department of Safety psychologists that offer help to employees who seek assistance for alcohol or drug abuse and other personal or emotional problems.

Within the legal framework and with these basic objectives in mind, the City has established the following policy with regard to use, possession or sale of alcohol or drugs.
I. ON-THE-JOB USE, POSSESSION OR SALE OF DRUGS OR ALCOHOL

A. Alcohol

Being under the influence or impaired by alcohol by any employee while performing City business or while in a City facility is prohibited. Consumption of alcohol in a City facility, in a City vehicle or on City premises is prohibited unless consumed at an officially sanctioned private function, e.g., an invitation only library reception.

B. Legal Drugs

It is the responsibility of the employee who works in a position operating a vehicle or dangerous equipment or affecting the public health or safety to advise management that he or she is taking a prescription drug which may affect performance. The use or being under the influence of any legally obtained drug by any employee while performing City business or while in a City facility may be prohibited if such use or influence may affect the safety of co-workers or members of the public, the employee’s job performance, or the safe or efficient operation of the City facility. An employee may continue to work, even though under the influence of a legal drug, if the appointing authority or a designee has determined, after consulting with the Occupational Health and Safety Center that the employee does not pose a threat to his or her own safety or the safety of co-workers and that the employee’s job performance is not significantly affected by the legal drug. Otherwise, the employee may be required to use sick leave or take a leave of absence or comply with other appropriate non-disciplinary action determined by the appointing authority or a designee.

C. Illegal Drugs

The use, sale, purchase, transfer or possession of an illegal drug by any employee while in a City facility or while performing City business is prohibited. For the classified service employees and the deputy sheriffs of the Department of Safety, the presence in any detectable amount of any illegal drug in an employee at any time is prohibited.
II. PROCEDURES FOR MANAGEMENT AND SUPERVISORS

When a supervisor has reasonable suspicion that an employee is in violation of this policy, the supervisor should immediately consult with an appropriate member of the in-house personnel staff or with the City Attorney’s Office to determine further actions. However, if it is recognized that the employee appears to be under the influence of drugs or alcohol, or alcohol or drugs are in his or her possession, immediate action may be required.

Where this is the situation, the supervisor should do the following:

A. Under the Influence of Alcohol

The supervisor should confront the employee with the suspicion and order the employee to the Occupational Health and Safety Center (during work day hours). **If the clinic is closed, refer to Denver General Psychiatric and Substance Abuse Emergency Room Service** or the Denver Police Department DUI facilities for an evaluation. Arrangements are to be made by the supervisor to provide transportation for the employee to the evaluation site. If the employee refuses to be evaluated, arrangements should be made for the employee to be transported home.

*Caution:* Once a supervisor has reasonable suspicion that an employee appears to be under the influence of alcohol and should the employee refuse an order to be evaluated and drives off in their own or a City vehicle, the police must be notified immediately.

B. Use, Possession, or Sale of Illicit Drugs

When a supervisor has reasonable suspicion that an employee appears to be using illicit drugs while on duty, the same procedure applies as when a supervisor has reasonable suspicion that an employee appears under the influence of alcohol.

When a supervisor has reasonable suspicion that an employee appears to be in possession of or selling or transferring illicit drugs, the police are to be contacted. It is the policy of the Department of Safety for all classified service employees and deputy sheriffs that improper use or possession of controlled substances is grounds for immediate dismissal.

Management and supervisors are to restrict conversations concerning possible violations of this policy to those persons who are participating in the evaluation, investigation or disciplinary action and who have a need to know about the details of the drug/alcohol
investigation. This includes not mentioning the name of the employee or employees suspected of violating this policy.

C. Drug and Alcohol Screening

Employees may be required to submit to blood, or urine, or other alcohol or drug screening where there is reasonable suspicion of illicit use or the employee is under the influence of or impaired by alcohol or drug. Drug and alcohol screening may also be justified where, even though the employee does not exhibit any observable symptoms of being under the influence, a workplace accident may have been caused by human error which could be drug or alcohol related. If any specimen obtained in a drug screening remains after supervisor authorized testing, the remaining specimen is to be retained until adjudication of disciplinary action is concluded. The Occupational Health and Safety Center shall ensure that appropriate chain of custody is maintained for all specimens.

D. Investigatory Leave

The supervisor is then to contact management for further guidance. In the absence of such consultation and if the supervisor has a reasonable doubt about the employee’s ability to satisfactorily and safety meet job requirements, the supervisor shall place the employee on investigatory leave pending results of testing or other administrative determination.

III. DUI/DWAI ON OR OFF THE JOB

It is the responsibility of any employee who is required to drive as part of his or her assigned duties or job specification to report to his or her appointing authority any DUI or DWAI charge which results in the loss of a driver’s license or the restriction of driving privileges. Every employee who is required to drive as part of his or her assigned duties or job specification shall annually certify that he or she has a currently valid driver’s license.

IV. NON-COMPLIANCE BY EMPLOYEE

(Missing)

V. DISCIPLINARY ACTION

Violation of this policy can result in a disciplinary action, up to and including dismissal, even for a first offense. The appointing authority or designee, in lieu of disciplinary action, may enter into an agreement with the employee after consultation with the city
attorney’s office, for assessment of the employee’s alcohol or drug abuse problem and for any treatment suggested by the treatment plan developer. For Career Service Authority employees, the treatment plan developer is the Office of Employee Assistance and for classified service employees, the treatment plan developer is the department psychologist.

VI. FACILITY WORK RULES

Nothing in this policy precludes the appointment authority of any City agency from establishing work rules, which cannot be less stringent than this policy, subject to approval of the City Attorney.

VII. SEARCHES

Searches of employees to investigate work-related misconduct may be conducted when there is reasonable suspicion to believe that the employees are in violation of this policy, and where the scope of the search is reasonably related to the objectives of the search and not excessively intrusive in light of the nature of the misconduct. Supervisors shall contact the City Attorney’s office for guidance.

VIII. CONTRACT PERSONNEL

These policy provisions are applicable to contract personnel. Violation of these provisions or refusal to cooperate with implementation of the policy can result in the City’s barring contract personnel from City facilities or participating in City operations.

IX. POSTING NOTICES

Clearly posted notices explaining the City’s right to carry out search activities should be displayed in appropriate locations throughout the work area. Such postings should emphasize the City’s intention to maintain a safe and healthful working environment. In addition, a copy of the City’s Drug and Alcohol policy may be given to each employee with each employee acknowledging in writing receipt of the policy.

At a minimum, facility management is to inform all contractors doing work in the facility about the applicable policy provisions and provide a copy of this policy to such contractors. Certain other enforcement actions may be necessary.

X. DRUG AND ALCOHOL USE RELATIONSHIP TO THE OFFICE OF EMPLOYEE ASSISTANCE AND DEPARTMENT OF SAFETY PSYCHOLOGISTS
The City and County of Denver maintains an Office of Employee Assistance and provides Department of Safety psychologists that offer help to employees who suffer from alcohol or drug abuse and other personal emotional problems. It is the responsibility of each employee to seek help from the Office of Employee Assistance or Department of Safety psychologist before alcohol and drug abuse problems lead to disciplinary problems. Once a violation of this policy occurs, subsequent use of the Office of Employee Assistance or Department of Safety psychologist may be part of a condition of continued employment.

APPENDIX

Federal Rehabilitation Act of 1973


“Individual with handicaps” means any person who has a physical or mental impairment which substantially limits one or more of such person’s major life activities, (ii) has a record of such impairment, or (iii) is regarded as having such an impairment. For purposes of sections 503 and 504 as such sections relate to employment, such term does not include any individual who is an alcoholic or drug abuser whose current use of alcohol or drugs prevents such individual from performing the duties of the job in question or whose employment, by reason of such current alcohol or drug abuse, would constitute a direct threat to property or the safety of others.”

Colorado Revised Statutes

Under the Colorado Statutes, it is a discriminatory or unfair employment practice:

(a) For an employer to refuse to hire, to discharge, to promote or demote, or to discriminate in matters of compensation against any person otherwise qualified because of handicap, but, with regard to a handicap, it is not a discriminatory or unfair employment practice for an employer to act as provided in this paragraph (a) if there is no reasonable accommodation that the employer can make with regard to the handicap, the handicap actually disqualifies the person from the job, and the handicap has a significant impact on the job;

Career Service Authority
Under Career Service Authority regulations, it is a ground for immediate dismissal for an employee to:

(b) Be under the influence of alcohol while on duty (CSA 16-22(3)) or illegally (use) habit forming drugs or narcotics, or marijuana on City and County premises or while on duty; or illegally (introduce) or (possess) such substances on City and County premises while on duty. (CSA 16-22(1) or refuse to comply with orders of an authorized supervisor.)

Denver Fire Department

Under Denver Fire Department policy, using or being under the influence of alcohol while on duty, or use, possession or illegal activity involving drugs and controlled substances are major violations. Use or being under the influence of alcohol on duty is a major offense because the nature of the fire service requires quick, accurate, efficient judgments to be made. Alcohol may impair a member’s ability to perform effectively, thereby endangering other members and the public. 1) First Offense: Suspension of up to one year. The firefighter may be reinstated if he can prove treatment and rehabilitation. 2) Second Offense: Dismissal.

The Department’s drug policy states that:

Members shall not use or possess any prescription drug, on or off duty, except as prescribed by and under the supervision of a licensed doctor or dentist. The use of any illegal drug, controlled substance, or other substance; the possession of any illegal drug or substance, or any participating activity involving illegal drugs or substances on or off duty, may subject member to the following discipline: First Offense: Dismissal.
Name: _____________________________________________

LAST,                         FIRST,                                       MI

SSN: ______________________________________________

CERTIFICATE OF COMPLIANCE WITH DRUG-FREE
WORK PLACE ACT OF 1988

(Public Law 100-690, Title V, Subtitle D)

I certify that I have received a copy of Executive Order 94, as amended, regarding
the alcohol and other drugs policy for City and County of Denver employees.

I further certify that I will not unlawfully manufacture, distribute, dispense,
possess or use a controlled substance in the work place, and I will notify my
employer of any criminal drug statute conviction for a violation occurring in the
work place no later than five days after such conviction.

_________________________________________________
Employee’s Signature

_________________________________________________
Date

CSA ORIGINAL: ATTACH TO APPOINTING PERSONNEL ACTION -
MAKE COPY FOR AGENCY FILE
Section B

Denver Fire Department
Standard Operating Guidelines
PURPOSE: To define each rank’s duties, responsibilities, and chain of command in Operations

SCOPE: Applies to all DFD Operations members

All ranks shall meet the criteria defined within the job description on file at the Civil Service Commission. All ranks shall be familiar with and abide by the following:

A. All Department Directives/Guidelines
B. All established Departmental safety standards and policies
C. All guidelines and standards pertaining to their assignment
D. Maintain the physical ability to perform the functions related to their assignment
E. Notification in writing of citations, restrictions, suspension, or revocation of driver’s license
F. Suppression forces shall be properly attired, prepared, and on duty at 0730 hours.

I. DIVISION CHIEF OF OPERATIONS

Next in rank below Deputy Chief, Division Chiefs are appointed by the Chief of the Department.

Directs the management of all Suppression activities, Technical Rescue disciplines, Hazardous Materials response and mitigation, cost recovery, research and development of equipment, and OEM

II. ASSISTANT CHIEF

Next rank below that of Division Chief. When assigned to suppression, Assistant Chiefs direct rescue and firefighting activities at the command level and manage their Fire District on their shift. Operations Assistant Chiefs are to keep current of the technical and practical applications of firefighting techniques and all phases of fire suppression. Operations Assistant Chiefs shall be assigned one of the following three duties by the Operations Division Chief: District Commander, Training Chief, or Fire Prevention Chief. They are responsible for administering the daily staffing conference, moving personnel as needed to balance staffing or meet Department needs by utilizing Telestaff. Document all overtime within Telestaff and on the tote board. Receive notice for sick leave, funeral leave, and
have the appropriate backfill utilizing Tellestaff. When assigned to support functions, they act as senior managers within their Division.

A. District Commanders, in cooperation with other assigned Chiefs, are responsible for:
1. Formulating and posting district policies and administrative procedures after they have been approved by the Division Chief of Operations
2. Approving, denying, and administering district transfers and staffing according to the Transfer Policy
3. The effective distribution and placement of personnel throughout the district, in accordance with established Department policies
4. Approving and/or disapproving all physical fitness activities in their district
5. Assisting the Operations Division and the Administration Division in the review, revision, and implementation of protocols and procedures necessary to ensure fair and effective personnel practices
6. Monitoring the condition of Department facilities within their district and assisting Captains in securing necessary maintenance and repair
7. Monitoring community relations programs in their district

B. District Safety and Training Chiefs are responsible for:
1. Ensuring that all training operations are carried out in a safe manner, adhering to written and prescribed procedures
2. Ensuring that all operations members have at a minimum one designated training conducted by the District Training Chief at least once a quarter
3. Ensuring that all companies in their district are tested on the company standards twice a year.
4. Assisting in the review, revision, and implementation of protocols and procedures necessary to ensure safe fire ground operations
5. Supervising and administering district training programs as developed in coordination with the Safety and Training Division
6. Assuring that training is carried out within time parameters identified
7. Designating and supervising the district training program
8. Acting as a communication link between the Safety and Training Division and the district
9. Reviewing company records on a regular basis to verify daily training

C. District Fire Prevention Chiefs are responsible for:
   1. Acting as a communication link between the Fire Prevention Division and the district
   2. Developing and maintaining a program to identify and pre-plan critical occupancies and target hazards within the district
   3. Supervising the district fire inspection program and general inspection practices
   4. Monitoring for proper completion of all inspections prior to forwarding completed inspections to the Fire Prevention Division
   5. Reviewing and assisting with resolution of referrals prior to forwarding them to the Fire Prevention Division (this does not preclude referral of immediate life threatening violations directly to the Fire Prevention Division by other assigned District Chiefs. When this is necessary, the District Fire Prevention Chief should be informed.)
   6. Assessing overcrowding in public assembly occupancies and other Fire Code violations in public assembly occupancies
   7. Fielding questions regarding the inspection program from citizens and members of the Department.

III. ASSISTANT CHIEF OF OPERATIONS

Reports directly to the Division Chief of Operations. Responsibilities include:

A. Meeting all criteria defined in the Assistant Chief’s job description on file at the Civil Service Commission.
B. Being familiar with and abiding by:
   1. All Department Directives/Guidelines
   2. All established Departmental Safety standards, polices, and procedures
   3. All Operations Division Directives/Guidelines
   4. All guidelines and standards pertaining to their assignment
C. Assisting in the review, revision, and implementation of protocols and procedures necessary to ensure safe, effective technical operations
D. Maintaining the physical ability to perform the functions related to their assignment.
Operations Assistant Chief, in cooperation with the other assigned Chiefs, is responsible for:

A. Acting as the Administrative Assistant to the Operations Division Chief
B. Carrying out all duties within the scope of the Operations Division
C. Knowing the Operations Division Chief’s administrative duties and being able to perform in that position whenever the Operations Division Chief is unavailable.
D. Knowing the technical and practical applications of the latest firefighting techniques and keeping current in all phases of fire suppression
E. Acting as aide to the Incident Commander or Operations Section Chief when on scene at incidents
F. Staffing the position of Emergency Support Function (ESF) #4 when required by the Office of Emergency Management (OEM). If Operations Assistant Chief is unavailable, this position will be staffed by another Assistant Chief
G. Assigning/scheduling Operations companies to various Department training events
H. Scheduling outside agencies to present pertinent information to Operations members as needed
I. Working with other City agencies and outside organizations to meet the needs of the Department and the goals of the Operations Division
J. Managing the Public Safety Cadet assigned to Operations
K. Receiving and addressing all complaints related to Operational concerns. These complaints will be logged in to CUFFS or another suitable Department approved complaint tracking system. District Chiefs may be asked to assist with investigation and discipline throughout the complaint process.
L. Tracking Telestaff documentation of overtime and other related issues.

IV. ASSISTANT CHIEF OF SPECIAL OPERATIONS

Reports directly to the Division Chief of Operations. Responsibilities include:

A. Responding to all Special Operations Incidents in the City and County of Denver as well as mutual aid incidents region wide. At these incidents, functioning as an integral part of the technical rescue teams and/or assisting the incident commander. Special Operations incidents include, but are not limited to, water rescue, swift water rescue, high angle rescue, confined space rescue, building collapse, trench rescue, hazardous materials incidents, mass decon incidents, mass casualty incidents, machinery extrication, and wildland incidents.
B. Maintaining knowledge and proficiency in all areas of technical rescue.
C. Coordinating daily with the officers on Specialty Companies and their respective District Chiefs to ensure that technician staffing levels are maintained at a sufficient level to safely respond on any and all technical rescue responses each day.

D. Planning, developing, and implementing training for all of the personnel assigned to specialty apparatus. Working with the Captains of the Specialty companies to ensure that the training needs of their companies are being met.

E. Assisting the Captains of the Specialty apparatus with the needs of their companies. This includes, but is not limited to, equipment procurement and implementation of new procedures.

F. Assisting the Operations Division with the annual review of Standard Operating Guidelines relating to technical rescue responses. Assisting with updating existing SOGs as needed and coordinating the implementation of new SOGs that pertain to technical rescues.

G. Working with other agencies within the City and County of Denver (Office of Emergency Management, Denver Health and Hospitals, Denver Police Department, etc.) in order to ensure that the City and County of Denver is prepared for multi-agency technical rescue incidents.

H. Working with other technical rescue teams in the region and multi-regional agencies in order to ensure that the Denver Fire Department Technical Rescue Teams can work seamlessly throughout the metro region.

I. Overseeing research and development of tools and equipment. This includes working with vendors, manufacturers, and DFD personnel to test and evaluate existing and new tools and equipment. Also, working with the Purchasing Department of the City and County of Denver to implement, ensure compliance with, and renew tool and equipment bids.

J. At hazardous materials incidents, functioning as the code enforcement and cost recovery specialist. Responsible for working with the Fire Prevention Division after these incidents to ensure code compliance. Cost recovery responsibilities include determining the identity of the responsible party or corporation, cost assessment, and billing.

V. CAPTAIN

When assigned to suppression, Captains direct the activities of their company on their shift, may act as Assistant Chief in the absence of the assigned Chief, manage or share management of their assigned station, and perform the duties of emergency scene command as appropriate.
House Captains shall:

A. Maintain the Division’s library, including but not limited to the following:
   1. Department Directives
   2. Department Standard Operating Guidelines
   3. Denver Metro EMT – Basic Protocols
   4. Probationary Field Training Handbook
   5. National Incident Management System (NIMS)
   8. Denver Fire Department Driving Manual
   9. IFSTA Manuals
   10. Any materials assigned by the Chief of Department or his designee

B. Post the following information:
   1. Division Policy Statement
   2. House Rules
   3. Current memoranda
   4. Current Executive Orders
   5. Civil Service information
   6. Union information
   7. Firefighter Protective Association information
   8. Cleaning and maintenance schedules
   9. DFD activities calendar
   10. Training information
   11. Information on special hazards
   12. Peer Support information
   13. Current Sexual Harassment Policies
   15. Any information as assigned by the Department Chief or his designee

C. Be notified of all activities to take place under their command and may cancel such activities if they are not in the best interest of the Fire Department

D. Inspect their workplace regularly for cleanliness, needed repairs, and safety, and report needed items to the applicable subdivision for correction

E. Be informed of all activities, modifications, repairs, and additions to their workplace, and shall maintain this information in a log so that all members may be kept informed
DENVER FIRE DEPARTMENT

STANDARD OPERATING GUIDELINE

Topic No: 2101.01
Date: 06-22-11
Approved: TAB
Review Date: 06-22-13
Replaces: OPs DIRs entire section 102 (various dates)

Section: OPERATIONS: RANK

Topic: Rank Structure

F. Maintain the house fund, either personally or through their designated representative. Captains will ultimately make final budgetary decisions where discrepancies occur in fund allocations.

G. Train regularly to ensure that all members under their command are familiar with all maintenance schedules and procedures.

H. Maintain control over all keys to their assigned buildings to ensure workplace security.

I. Be responsible for monitoring their assigned budget and ordering the monthly supplies.

J. Perform all other duties assigned by supervisors.

K. Maintain and keep secure all personnel records, files, and other confidential information.

L. Ascertain that all members are aware that no confidential information, including addresses, phone numbers, Social Security numbers, etc. are to be released to non-Department personnel.

M. Have full charge of their junior officers and members.

Company Captains shall:

A. Determine company policy which is consistent with Department Directives/Guidelines.

B. Be trained to proficiently perform the duties and responsibilities of a District Chief, and act in that capacity when temporarily assigned.

C. Directly supervise and control the operation of a single piece of fire apparatus on his/her assigned platoon and be responsible for the operations of their company on other platoons relating to training, inspections, maintenance, etc.

D. Prepare disciplinary paperwork as necessary and present to their District Chief any incompetence, neglect of duty, disobedience, or violation of Department Directives or Guidelines by any member of their company.
   1. Preserve order and discipline.
   2. Be responsible for enforcing procedures, policies, and directives from supervising officers.
   3. Be responsible for processing and handling grievances as set forth in Department Directives and collective bargaining agreements.

E. Call the roll and inspect all members of their shift promptly at 0730 hours daily. Suppression duty shift shall be from 0730 one calendar date to 0730 the following calendar date.

F. Temporarily transfer company members as directed by their District Chief according to Department Directives.

G. Require safe operation of their apparatus at all times.
H. Take command at fires or other emergencies as outlined in the Incident Management System

I. Determine the cause of the fire whenever possible. In the event they are unable to determine the cause, or if fire is of suspicious origin, notify the Fire Investigator and take the following steps:
   1. Stop overhaul operations, except those necessary to assure the fire is extinguished.
   2. Secure the premises from entry by all unauthorized persons, including on scene Firefighters.
   3. Avoid touching or disturbing any objects so as to prevent destruction or alteration of potential evidence.

J. Be responsible for the proper placement and use of all personnel, equipment, and apparatus assigned to them at incidents

K. In the event of an emergency at the shift change, the Captain of the oncoming platoon shall call the roll and consult the Dispatcher to see if members should go to the emergency scene or remain in quarters. If needed at the emergency, respond and report to the Incident Commander.

L. Upon returning to quarters from fires or other emergency responses:
   1. Fill out incident reports as required by the Department within 72 hours of said incident
   2. Report the loss or destruction of any Department equipment entrusted to their care to their District Chief through the chain of command, stating details and actions to prevent further loss
   3. See that the apparatus and all equipment are ready for future responses
   4. Immediately report to the Fire Dispatcher any difficulties encountered with fire hydrants. During freezing weather, upon return to quarters they shall report to the Dispatcher the location of fire hydrants used.

M. Keep their District Chief informed of all changes that affect the operation of their company

N. When assigned to a company that performs specialized operations such as HazMat, Decon, and/or other technical rescue operations, they shall be required to develop and maintain the requisite skills, knowledge, and certifications necessary to qualify as a professional rescue technician as outlined in NFPA Standards 472, 1006, and 1670, EPA Guideline 1910.120, and other applicable standards. They shall also be required to proficiently direct and perform as a part of a team involved in hazardous material operations or technical rescue operations.

O. Be responsible for company training and the proficient operation of their company
1. Develop a program of drills and/or classes to be held on a regular basis to maintain proficiency
2. Ensure completion of assigned training outlined by the Operations Division, Safety and Training Division, and the District Training Chief
3. Document all training in the Firehouse computer program

P. Be responsible for evaluating all probationary members assigned to them
   1. Determine whether the members’ performance meets Department standards
   2. Forward recommendations to their District Chief
   3. Ensure that evaluations are forwarded to the Training Division as required

Q. Under the supervision of their District Fire Prevention Chief, be responsible for coordinating the company fire inspection program
   1. Distribute the assigned inspections equitably among all platoons
   2. Be responsible for all members of their company being trained in inspection procedures as outlined in Department Directives

R. Be responsible for the accuracy of company records and the submission and distribution of all required documentation

S. Sign for articles delivered to the station

T. Be just and dignified in all matters
   1. Greet all visitors to their station in a courteous and dignified manner, determining visitor business and enforcing the visitor rules
   2. Do not permit social gatherings in quarters unless authorized
   3. Prohibit unauthorized persons and unaccompanied children from visiting buildings and premises
   4. Set a good example

U. Assign duties in an equitable manner to balance the workload among platoons
   1. Schedule all daily, weekly, and monthly maintenance of their apparatus and equipment. These schedules should be posted for the use of the company members.
   2. Ensure that quarters, grounds, apparatus, and equipment are kept clean and serviceable at all times
   3. Maintain an apparatus repair and maintenance log showing required repairs, repairs made, the Mechanics and/or Linemen who responded, and the date and time repairs were reported and completed
   4. Maintain a current inventory of all equipment assigned to them
V.  Be responsible for the fair and equitable distribution of hold over overtime and acting for their company
   1.  Designate members qualified to act as officers and Engineers and maintain a current list of qualified members
   2.  Maintain a current hold over overtime and acting roster showing dates and times worked by company members

VI  CAPTAIN OF OPERATIONS

Next rank below that of Assistant Chief.  Reports directly to the Assistant Chief of Operations and/or the Division Chief of Operations.  Assists the Assistant Chief of Special Operations.  Functions as the Department’s Infection Control Officer.

A.  Operations Responsibilities:
   1.  Assist the Operations Assistant Chief with maintaining the Operations Activity Calendar.
   2.  Keep Operations Activity Calendar up to date with timely and accurate entries.
   3.  Assist the Operations Assistant Chief with resolving Activity Calendar conflicts and scheduling needs.
   4.  Assist the Operations Assistant Chief with coordination and scheduling of In-Service Training.
   5.  Coordinate with the Safety and Training Division regarding training that involves Operations companies and members.  This will include the SAFE Test and Annual Fitness Testing.
   6.  Stay prepared and informed about, and participate in the Daily Staffing Conference.
   7.  In the absence of the Operations Assistant Chief, place the morning call to the District Commander running the conference to update them on the activities of the day.
   9.  Review and update tool and equipment bids as assigned to increase standardization, and ensure that the best tools and equipment are available for use by the members.  Work closely with the City and County of Denver Purchasing Division.
  10.  Research and test tools and equipment as requested to achieve item 9 above.  Conduct and document field testing.
11. Represent the Operations Division in meetings and preparedness exercises with other City departments and/or agencies and Federal agencies when requested.

12. Respond to significant incidents within the City when requested to provide assistance to the Incident Commander as needed.


14. Provide for exposure documentation for members exposed to carcinogens and other non-infectious or non-communicable disease contaminants (i.e. asbestos).

B. **Special Operations Responsibilities:**
   1. Respond to Special Operations incidents within the City when requested or when the Assistant Chief of Special Operations is not able to respond.
   2. Maintain knowledge and proficiency in all areas of technical rescue.
   3. Assist Special Operations Chief with coordination of daily staffing levels on Special Operations Companies.
   5. Assist in the development and annual review of Special Operations Standard Operating Guidelines.
   6. Assist in the research and development of tools and equipment for Specialized Rescue and Hazardous Materials response.
   7. In the absence of the Special Operations Chief, act as the back up code enforcement and cost recovery specialist at Hazardous Materials incidents.
   8. Administer and coordinate Hazardous Materials and Dive Physicals for team members with the COSH (Center of Occupational Safety and Health), formerly known as the Employee’s Medical Clinic.

C. **EMS Responsibilities:**
   1. Function as the DFD liaison to the DHHA Paramedic Division to coordinate training and certification.
   2. Operate as the DFD liaison to the DHHA Paramedic Division for conflict resolution and complaint reconciliation.
   3. Send a weekly DFD roster update to the EMS Education Lead Instructor.
   4. Conduct research and development on EMS and medical equipment. Facilitate the review and evaluation of EMS and medical equipment at the company level. Document the results of field testing. Utilize
company recommendations for the procurement of medical and EMS equipment.
5. Periodically review and recommend changes and updates as needed to the Safety and First Aid Supplies bid. Work closely with the City and County of Denver Purchasing Division to procure the best EMS supplies and equipment.
6. Maintain accurate file copies of all members’ CPR and EMT certifications. One copy shall be physically maintained in the Operations Division file folder. One copy shall be scanned and maintained in the Operations Division shared computer file folder.
7. Create and distribute an annual FCM regarding the EMS Training and Program Schedule for the year. This memo should go out between December 15 and January 15 of each year.
8. Coordinate CPR recertification for DFD members.
9. Coordinate EMT recertification for DFD members. Maintain a database and tracking system of CME hours for state recertification in cooperation with the DHHA EMS Education Lead Instructor.
10. Coordinate EMS Continuing Medical Education for all Department members using EMS Education personnel from DHHA EMS Education Department.
11. Administer and oversee the DFD AED program.
13. Attend the Denver Fire Department Safety Committee meeting each month.
14. Attend the monthly Communication Center/Response Time Committee meeting.
15. Create a dialogue with the DHHA Medical Director to maintain familiarity with ongoing changes in the medical field.
16. Schedule and participate in Firestation visits with the DHHA Medical Director.
17. Handle referrals for “911 abusers” with Adult Protective Services and follow up with APS case workers for resolution.

D. Infection Control Officer Responsibilities:
1. Serve as the Department “designated officer” as required by the Ryan White Comprehensive Aids Resources Act of 1990.
2. Ensure companies have EMS PPE available at all times.
3. Serve as the DFD Exposure Officer. Evaluate possible member exposures to communicable and infectious diseases.
a. Assist members with advice on the need for prophylactic treatment and evaluation of the need for a visit to the COSH.
b. Assist members with proper documentation of exposure incidents (i.e. FD207).

4. Coordinate the immunization program with the COSH.
5. Facilitate the yearly Tuberculosis Testing for DFD members:
6. Provide for all other responsibilities covered in the DFD Infection Control Policies and Procedures SOG.

VII LIEUTENANT

When assigned to suppression, Lieutenants direct the activities of their company on their shift and perform the duties of emergency scene command as appropriate. When assigned to support functions, Lieutenants serve as line officers who direct and/or complete tasks within the scope of their responsibility.

Lieutenants must meet all the criteria for the rank of suppression Captain from headings “C” through “V”, above.

VIII ENGINEER

Non-supervisory position subordinate to a company officer. Engineers are responsible for the operation and assigned routine maintenance of their apparatus to which they are assigned. Engineers also perform firefighting duties as directed by their company officer. Engineers shall:

A. Be responsible for maintaining their apparatus in good operating condition and readiness at all times
B. Have a valid Colorado driver’s license and a proper Denver Fire Department license
C. When assigned to an engine, be familiar with the streets and fire hydrants within their assigned district, and when responding to an emergency, be responsible for selecting the best route and hydrant unless directed to do otherwise by the company officer
D. When assigned to an aerial or other apparatus, be familiar with the streets in their assigned district, and when responding be responsible for selecting the best routes unless directed to do otherwise by the company officer.
E. Professionally operate and maintain the apparatus, including all ladders, pumps, and other equipment assigned to their company
F. Remain at or near the control panel when the apparatus or equipment is in operation at emergency scenes and during all training sessions
F. Be capable of performing all Firefighter functions as assigned and assist other Firefighters with administering emergency treatment, implementing rescue, information gathering, and other Firefighter duties as their assignment allows.

G. Be responsible for conducting in-service training for other company members on apparatus function and the proper use of all equipment assigned to that apparatus.

H. Be responsible for performing all inspection duties and assist company members in said duties as directed by the company officer.

I. When assigned to a company that performs specialized operations such as HazMat, Decon, and/or other technical rescue operations, they shall be required to develop and maintain the requisite skills, knowledge, and certifications necessary to qualify as a professional rescue technician as outlined in NFPA Standards 472, 1006, and 1670, EPA Guideline 1910.120, and other applicable standards. They shall also be required to proficiently direct and perform as part of a team involved in hazardous material operations or technical rescue operations.

J. Carefully complete their fifty-six point checklist and submit the required documentation daily by 1000 hours.

K. Inform their company officer or immediate supervisor whenever material, supplies, or repairs are needed.

L. Not attempt to make repairs, adjustments, or modifications on apparatus. When repair or adjustments are needed, they shall be responsible for relaying this information to Fleet Maintenance through the company officer.

M. Perform such other lawful duties as prescribed by ranking officers.

N. Be responsible for the safe operation of their vehicle at all times.

O. Be familiar with and comply with the accident reporting and investigating of the Denver Fire Department, and applicable State laws.

IX. TECHNICIAN

A position in either suppression or support service designated by the Chief of the Department. Prior to being appointed, Technicians demonstrate that they possess special skills, technical expertise, and/or training beyond that attained by other Firefighters. Technicians shall be appointed and removed at the discretion of the Chief of the Department. Technicians shall:

A. Serve a minimum training period as designated by the Chief of the Department, in the unit where appointment is contemplated. Unit supervisors may request that the training period be altered or waived...
through the chain of command for members with prior experience. When members have demonstrated the skills, knowledge, and ability to perform the duties, the supervisor in charge of the unit shall submit a written evaluation of the member’s ability to perform the duties and responsibilities to the Chief of the Department.

B. Be capable of performing all Firefighter functions as assigned

C. When assigned to a company that performs specialized operations such as HazMat, Decon, and/or technical rescue operations, they shall be required to develop and maintain the requisite skills, knowledge, and certifications necessary to qualify as a professional rescue technician as outlined in NFPA Standards 472, 1006, and 1670, EPA Guideline 1910.120, and other applicable standards. They shall also be required to proficiently direct and perform as a part of a team involved in hazardous material operations or technical rescue operations.

D. Perform such other lawful duties as prescribed by senior officers

X. FIREFIGHTER

When assigned to suppression, Firefighters are subordinate to their company officer and perform as team members that mitigate emergency situations as directed. When assigned to support functions, Firefighters perform their duties as directed by the officers to which they are assigned. They shall:

A. Respond to all alarms as an integral part of a team assigned to one of the various types of Department apparatus

B. Inspect protective gear at the beginning of each shift to ensure serviceability

C. Inspect and maintain their apparatus, tools, and equipment for serviceability at all times

D. Participate in the daily maintenance of the station and grounds in accordance with the posted schedule

E. When assigned to a company that performs specialized operations such as HazMat, Decon, and/or other technical rescue operations, they shall be required to proficiently perform as part of the team under proper supervision.

F. Perform such other lawful duties as prescribed by officers

G. All Firefighters 3rd grade and above shall be Department emergency driver certified. All members shall be capable of proficient apparatus operation.

H. All Firefighters 1st grade and above shall be trained to proficiently perform company officer duties.
REFERENCES:  Civil Service Job Descriptions for ranks on the Fire Department
NFPA Standards 472, 1006, and 1670 for Rescue Technicians
EPA Guidelines, 1910.120
PURPOSE: To ensure Department apparatus is safely operated while in reverse

SCOPE: Applies to all members operating or riding on Department apparatus

Before operating apparatus in reverse, two firefighters shall position themselves near the rear of the vehicle. The two spotters should be safely positioned so that the engineer can see the spotter positioned on the engineer’s side of the apparatus, or the primary spotter, at all times. If at any time the engineer loses sight of the primary spotter, the engineer shall stop immediately until the spotter makes himself visible again. In case the apparatus does not have a minimum of four persons on board, the company officer will be required to act as one of the spotters located near the rear of the apparatus.

While operating in reverse, the officer, firefighters, and engineer shall work together to maintain a safe environment for the members, apparatus, and surrounding property.

Communications between the engineer and spotters shall include the use of hand signals. Standard signals include:

A. **Straight Back**: One hand above the head with palm toward face, waving back. Other hand at your side (left or right hand optional).

B. **Turn**: Both arms pointing the same direction with index fingers extended (driver will advise the spotter which way the turn will be made). The spotter then assists the engineer in backing apparatus.

C. **Stop**: Forearms crossed to form an X.

**NIGHT BACKING**

Signals will be the same. The spotter will assure that the spotlights on rear of apparatus are turned on before allowing apparatus to be backed. A flashlight may be carried, but at no time will it be directed toward the mirror.
PURPOSE: To set forth procedures pertaining to fire hose inventories, maintenance and annual testing of fire hose.

SCOPE: Applies to all members assigned to use, maintain and test fire hose

All Department hose shall be maintained by Station 15 personnel, this includes all maintenance, issuance of new hose and inventories located in Firehouse Software for each Engine Company and Truck Companies that carry hose. Any questions regarding fire hose, including changes to inventories, should be addressed to the Engine Officer at Station 15.

INVENTORIES:

The Department currently has the following sizes of fire hose in inventory:

<table>
<thead>
<tr>
<th>Size</th>
<th>Color</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 3/4”</td>
<td>White</td>
<td>Attack</td>
</tr>
<tr>
<td>2”</td>
<td>Green</td>
<td>High Rise Attack only</td>
</tr>
<tr>
<td>2 1/2”</td>
<td>White</td>
<td>Attack (not to be used in High Rises)</td>
</tr>
<tr>
<td>Lightweight 2 1/2”</td>
<td>Yellow</td>
<td>Attack/High Rise Attack</td>
</tr>
<tr>
<td>3”</td>
<td>White</td>
<td>Supply</td>
</tr>
<tr>
<td>5”</td>
<td>Yellow</td>
<td>Supply</td>
</tr>
</tbody>
</table>

All sizes with the exception of 5” are in 50’ sections, 5” come in both 35’ and 100’ sections. At no time should 2 1/2” hose be used for supply line.

All sections of hose contain an inventory number comprised of the year of hose along with the section number assigned by Station 15 that is stenciled up to 18 inches from each coupling and stamped on each coupling in the following manner (5” will not have coupling stamped):

13-xxx 13 is the year, xxx is the section number

High Rise hose is marked in the following manner in addition to the inventory number:

- 32 inches from the end of the female coupling shall be a circumferential 1/2” wide bold line with H.R. marked above the line.
- Approximately six inches from the male coupling “two straps male side”
- At the midpoint of the hose section shall be a circumferential ¾” wide bold line.
All hose shall be marked with the company colors on each coupling. This shall be completed by each company.

The recommended quantity of hose carried on Engine Companies and in the Station inventory is as follows:

**Attack Hose:**

It is recommended that each Engine company carry at least 600 ft of 1 3/4” and 1200 ft of 2 1/2” attack hose. More attack hose can be carried at the discretion of the Engine Captain and the Operations Division Chief. All Engine companies should have on their hose rack an amount of 1 3/4” and 2 1/2” hose that is equal to what is carried on the apparatus. Engine Captains should set up their attack hose in accordance with the hazards associated within their individual response districts.

**High Rise Attack Hose:**

Each Engine company shall carry 200’ of 2” High Rise Attack hose and 200’ of Lightweight 2 1/2” High Rise attack hose in accordance with SOG 2114. All Engine companies shall have an equal amount of 2” and Lightweight 2 1/2” High Rise attack hose on their hose rack.

**Supply Hose:**

Non-5” Engine companies shall have a total of 60 sections of 3” supply hose. Each non 5” Engine Company shall carry a split bed of 3” supply hose, loaded for a forward lay. Each engine company should carry at least 800 ft. of 3” in each hose bed, space permitting. The remaining sections of 3” are to be stored on the station hose rack.

5” Engine companies shall have a total of 30 sections of 3” supply hose. 5” Engine Companies shall have a split supply bed and carry at least 800’ of 5” supply hose, space permitting, and as much 3” supply hose that can be carried in the other bed. Each 5” Engine company shall have 500’ (5 sections) of 5” supply hose and the remainder of their 3” supply hose, to total 30 sections, on their hose rack.

All Engine Companies shall carry one 35’ section of 5” supply hose with storz couplings and one back-up 35’ section of 5” on their hose rack.
Ready Reserve Engine companies should make every attempt to maintain hose loads equal to or as close to the hose carried on the first line apparatus. If hose loads are different than first line apparatus, the Officer shall contact the Engine companies that surround them and the District Chief to notify them of the change in hose loads.

MAINTENANCE:

Any hose that is damaged and needs repair or needs to be decommissioned due to date shall be sent to Station 15 via the Warehouse Truck. The hose must be clean and dry and the damaged area should be clearly marked and easily identifiable. Hose with damaged couplings shall be rolled so the damaged coupling is on the outside.

Instructions for sending hose to Station 15 for maintenance:

1. Officer must log on to Firehouse using the same Login used for Training input
2. Click the “Inventory” icon on task bar at top
3. Click “Browse” and input hose number in “Hose ID” field. Hose ID must be the exact number on the hose - for example 05-100
4. Once the inventory page comes up for the specific section of hose entered, click on the “Maintenance/Test” tab.
5. Click the “Add” tab in the middle of the page above Scheduled Maintenance
6. Click new job.
7. Click on the “Notes” tab.
8. Click “Append.” Please tell us what exactly is wrong with the section of hose you are sending Station 15. Be descriptive for example; “hose is leaking approximately 15’ from female coupling”, “hose is twisted 6’ from male coupling,” etc. This includes any hose that is to be decommissioned; in the note section, put “hose decommissioned due to date.” Make sure to mark damaged area with rag tied around it. Once finished, it will spell check and it will have a time/date stamp along with the F number of the Officer logged in.
9. Use masking tape and mark “TO: Station 15, FROM: your station” and set out for the Warehouse to pick up and deliver to Station 15. The Warehouse will not pick up hose if not labeled correctly.

If a section of hose is sent to Station 15 without completing the Firehouse software component, the section of hose will be sent back. No work will be completed until the Firehouse component is completed.

Once hose is repaired, Station 15 will send the hose to the corresponding Station via the warehouse truck. All hose that has been repaired must be tested by the receiving Company according to the hose testing procedure that follows this section. New fire hose must always be
Hose Testing:

All Department hose shall be tested annually, according to the yearly schedule specified by the Division Chief of Operations. All testing shall be completed by the last day of the assigned month. The hose testing schedule will be released by the Operations Division no later than March 15th of each year.

Hose shall be tested to the following service test pressures according to NFPA 1962:

<table>
<thead>
<tr>
<th>Size</th>
<th>Service Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 3/4”</td>
<td>Test at 400 PSI</td>
</tr>
<tr>
<td>2”</td>
<td>Test at 400 PSI</td>
</tr>
<tr>
<td>2 1/2”</td>
<td>Test at 400 PSI</td>
</tr>
<tr>
<td>3”</td>
<td>Test at 400 PSI</td>
</tr>
<tr>
<td>5” (prior to 2014)</td>
<td>Test at 200 PSI</td>
</tr>
<tr>
<td>5” (2014 and newer)</td>
<td>Test at 300 PSI</td>
</tr>
<tr>
<td>5” (35’ sections and soft suctions)</td>
<td>Test at hydrant pressure</td>
</tr>
</tbody>
</table>

Single jacketed hose of any size or length is considered obsolete and shall not be tested. If any of this hose is encountered, it should be removed from service. Truck companies can use single jacketed 1 3/4” hose for their sump pumps if needed.

The Department decommissions any fire hose that is 15 years or older. Prior to testing remove any hose from service that meets this restriction.

Hose Testing Procedures:

A. Officer - log on to Firehouse and print out current inventory. Check accuracy of inventory to the hose being tested, any changes or discrepancies send to Station 15 via email. Use firestation15@denvergov.org to email changes.

B. Connect lines to outlets on the Engine and attach nozzle. There is no maximum length requirement on hose lines.

C. Hose lines shall not be attached to outlets at or adjacent to the pump operator.

D. Fill all lines at hydrant pressure; bleed off air in the line and ensure couplings are tight.

E. Mark each section of hose at each coupling where the hose attaches with a pencil to determine any separation between the hose and the coupling during the test.
F. Discharge gates should be open only slightly when pressurizing the hose lines to prevent potential hose-whipping should ruptures occur.

G. Slowly raise the pump pressure to the desired level and hold that pressure for five minutes (NFPA 1962).

H. During the test, a nozzle must be attached to a 2-1/2” discharge and be open so that water is flowing from the pump to avoid damaging overheating of the water in the pump.

I. While the hose is at test pressure, inspect for leaks while standing 15’ to the side of the hose.

J. The hose shall be inspected for hose/coupling separation after the test has been completed and the pressure has been reduced to hydrant pressure.

K. Hose lengths of 40’ or less shall be removed from service.

L. If the hose is seeping and only the outer jacket is chafed through or has a hole in it, do not send it in for repairs; this hose is serviceable.

Once testing is completed, complete the following steps in Firehouse:

1. Officer must log on to Firehouse using the same Login used for Training input.
2. Click the “File” tab at top left and place cursor on “Apparatus, Equipment and Inventory”. This opens a new menu to the right, click on “Batch Maintenance/Test Entry.”
3. Enter your Station number in “Station” field and click Browse.
4. Right click anywhere in the list of hose and click “Select all.” This will highlight all sections in blue.
5. Hold the Control key (CRTL) and click on the individual sections that did not pass the test, this includes all sections that are out of date. These sections will need to be entered individually according to the “Maintenance” instructions. Once all sections that did not pass are not highlighted, click “Ok.”
6. The “Maintenance/Test” page will be on the screen. Click on box next to yellow “Job” window. Double Click "Hose Test."
7. Click on "Details" and complete checklist. This checklist will apply to all hose that passed the hose test.
8. Click on the “Notes” tab.
9. Click “Append” and enter "Annual Hose Test."
10. Click "Save."
11. Complete the instructions for "Maintenance" for each individual section of hose that did not pass the hose test.

References: NFPA 1962
PURPOSE: To identify the composition, response, and duties of the Rapid Intervention Team and/or RIT Group / Branch

SCOPE: Applies to all Operations, Dispatch, and Support Service members involved in or assisting with an incident where a RIT has been assigned

Section A: Composition

1. At the onset of the incident, the dispatcher shall assign a company the designation of RIT.
2. Any company assigned to the RIT function shall be staffed with a minimum of four firefighters. If the company has less than four firefighters, Dispatch and the first due Chief shall be notified immediately by the responding Company Officer.
3. Depending on the size and scope of the incident, additional companies may be assigned Level I RIT duties.

Section B: Response

1. A RIT shall be dispatched Code 10 to all structure fires and to any incident where firefighters are entering an IDLH atmosphere.
2. Any company assigned as RIT will generally not assume a firefighting or emergency operations role unless activated or otherwise directed by the IC. RIT should only be reassigned after a new RIT has been established. However, should the RIT have to take immediate action to affect a firefighter rescue and/or address some other safety-related rescue, they shall notify the IC immediately.
3. At the termination of the incident, a PAR should be called to assure accountability of all on-scene companies prior to releasing the RIT from the scene.

Section C: Pre-Activation Duties

1. Upon arrival, the RIT shall report to the Incident Commander with all members, full PPE, forcible entry/exit tools, Thermal Imaging Camera (TIC), and RIT pack. The RIT officer should receive an update on situation status and accountability from the IC.
2. Prior to activation, the RIT should remain outside of the IDLH atmosphere and be fully prepared to deploy immediately to assist troubled firefighters.
3. The RIT shall constantly monitor the designated tactical channel and maintain a continual working knowledge of the location of all companies operating in and around the incident.
4. The RIT team should perform a 360-degree survey, if possible, utilizing the RIT RECON acronym as a size up tool, and report any pertinent information to the Incident Commander immediately. The RIT RECON acronym stands for: R – Rescue Plan; E – Egress/Access; C – Construction; O – Outside Survey; N – Nasty Hazards.

Section D: Equipment

1. The following equipment shall be the minimum that a RIT should report to the command post with:
   a. Thermal Imaging Camera
   b. RIT Pack:
      1 300’ rope bag with 3 - 25’ Group Search Kits
      1 Five ring harness with 1 large carabiner
      1 Pair of tin snips
      1 75 min. air cylinder, face piece and regulator
   c. Hand tools (forcible entry/exit)
   d. Portable radios

2. All truck companies are equipped with a RIT pack. The location of the pack shall be clearly marked with a gold firefighter sticker that indicates the location of a RIT pack within that compartment. If the gold sticker is not present, the compartment with the RIT pack should be clearly marked to alert members to its location. Members shall become very familiar with the contents and operation of the RIT pack and its location on the truck companies with which they normally respond.

Section E: Activation

Incident Commander Responsibilities:

Upon report of a “Mayday” (lost, downed, trapped, or missing firefighter), the IC should:

1. Acknowledge Mayday
2. Deploy RIT
3. Notify Dispatch of RIT activation
4. Start PAR to verify ID of crew and firefighter(s) to help determine last location of member(s)

The IC should consider the following:
1. Establishing a RIT Group / Branch to coordinate resolution of the Mayday situation;
2. Leaving the RIT Group / Branch companies and the firefighter(s) in distress on the initial tactical channel during the rescue operation; all uninvolved units may move to a separate tactical channel as designated by the IC;
3. Calling a PAR in the case of a radio channel change for units already operating at the emergency scene, to ensure all companies have tuned to the correct channel;
4. The need for additional resources based on the scope and complexity of the incident, including but not limited to the following:
   a. Rescue One
   b. Tower One
   c. Collapse Unit
   d. Hamer One
   e. Additional alarms
   f. DFD Structural Engineer
   g. DFD USAR personnel
   h. Air Shovel
   i. Mutual Aid;
5. Assigning a dedicated Safety Officer to the RIT operation; and
6. Withdrawing unnecessary companies from affected areas based on a risk/benefit analysis of continuing operations that are not directly associated with rescue efforts.

Dispatch Responsibilities:

Upon notification of a RIT activation, the dispatcher shall do the following:

1. Notify the Dispatch Officer of the Mayday call as soon as possible;
2. Acknowledge the Mayday call and simulcast the alert tone calling for radio silence, and
3. Activate Level II RIT Group / Branch, which shall consist of not less than the following:
   a. One Engine
   b. One Truck
   c. One Assistant Chief

RIT Group / Branch Responsibilities:

1. The primary mission of the Level I RIT is to locate and stabilize the victim(s) and report the location, the victim(s)’ condition, and extrication
resource needs to the RIT Group Supervisor / Branch Director. Professional knowledge and experience should dictate actions. If a rescue can be made with the immediate resources available, the rescue should be completed.

2. The mission of the Level II RIT Group / Branch is to first complete any Level I RIT duties that were unable to be performed by the initial RIT team such as locating the downed firefighter, then progress toward extrication and rescue. The RIT Group Supervisor / Branch Director should consider the following:
   a. Assigning the Level II RIT Engine to secure an additional water supply and deploy a protective hose line for protection of firefighter rescue
   b. Assigning the Level II RIT Truck/Tower to perform rescue and extrication

3. Consider the need for additional equipment such as:
   a. Power saws
   b. Extrication tools
   c. Air bags
   d. Protective hose lines
   e. Five gas meter
   f. Lights
   g. Additional Ropes
   h. Ladders
   i. Hose lines

4. Based on the size and complexity of the incident, the RIT Group Supervisor / Branch Director should consider the need for additional RIT resources.

5. The RIT Group Supervisor / Branch Director should keep the IC updated on the progress of the rescue and needed resources.

REFERENCES:

Firescue Interactive, Rapid Intervention Team Recon, FDTN Volume 6, Issue 12, December 2002, David McGrail


Fire Engineering, Engine Company Support of RIT/FAST Operations, Andrew Fredericks

Intervention for Rescue of Members SOG – Aurora Fire Department, Colorado
Rapid Intervention Crew SOP – West Metro Fire Rescue, Colorado

DFD Training Manual
PURPOSE: To establish a guideline for operating at a natural gas emergency

SCOPE: Applies to all Denver Fire Department personnel responding to a natural gas emergency

I. CONSIDERATIONS

Natural gas is much lighter than air and will usually dissipate rapidly in the outside environment. Inside buildings, however, it tends to pocket, particularly in attics and dead air spaces. The flammable limits are approximately 5% to 15% in air. These low explosive limits create the possibility of the air/gas mixture being too rich for an ignition to occur until after fire department intervention. Natural gas itself is non-toxic; however, it displaces oxygen and can result in asphyxiation if in a confined space. Carbon monoxide will not be found during a natural gas leak unless it is being burned. Flammable gas ranges can only be determined by a combustible gas instrument.

All firefighters that enter a potentially explosive atmosphere must wear all of their personal protective equipment, including SCBA. All electrical switches shall be left in the position found. Doorbells and other sources of spark-producing mechanisms should be guarded against accidental activation.

Because of the potential for an ignition source, portable radios must be turned off prior to entering the structure and should only be used to transmit when outside of the area, or until the determination has been made that the leak is controlled and the atmosphere is out of the explosive range.

It may be necessary to have the electricity to the structure shut off. Mercury switches in a thermostat create a spark when activated. This hazard can be eliminated by turning off the breaker switches that are generally located outside of the building; consider the possibility of gas permeation into the breaker box from the structure. In instances where it is impractical for fire crews to shut off the power supply, Xcel Energy shall be contacted.

Shutting off the gas at the meter is the quickest way to eliminate all of the pilot lights as well as the leak.
II. ENGINE COMPANY OPERATIONS

The first arriving engine company has the responsibility of securing a water supply and being prepared to have an attack line ready in the event of fire or explosion. The first-in engine officer has the option of:

A. Reverse lay, from the affected building to the hydrant.
B. Staging at the nearest hydrant.
C. Laying in short of the building.
D. Laying in well past the building. (This is preferable, as size-up can be conducted on three sides of the building.)

If the engine company has laid a supply line, the engine shall not be spotted directly in front of the building.

A. In areas that have an immediate truck company response, the first-in engine crew shall not enter the building.
B. When necessary, the first-in engine company shall lay a supply line; the crew shall ready an attack line and remain outside of the building.
C. The crew shall not position themselves directly in front of the building.
D. All personnel shall have their full PPE on, including SCBA.

If the leak is large and ignition has not taken place, the first engine crew shall ready an attack line. If a structure fire is burning or an explosion has occurred in a structure, the initial attack shall be performed by the first-in engine. The minimum attack line shall be a 1-3/4” hand line.

If heavy concentrations of gas are detected, the members shall exit the building and shut down the gas from the meter outside.

In areas where the first-in truck company is several minutes away, the crew of the engine company shall secure a water supply and, if conditions warrant, ready an attack line. Two members of the crew may enter the building to locate and secure the gas leak. A truck company arriving after a company that has initiated an investigation shall not enter the area unless requested to do so by the incident commander.
III. TRUCK COMPANY OPERATIONS

The first-in truck company shall spot the truck well beyond or short of the building. The truck shall not be spotted directly in front of the building.

The truck company officer shall establish incident command and build the command structure as the situation dictates and available resources allow. Two crew members shall be sent to locate and secure the gas leak. One member should be sent to locate the gas meter and be prepared to shut it down if necessary. Any additional staffing requirements or additional resources needed should be relayed to the incident commander immediately. All later arriving units shall stage away from the building and wait for orders from the incident commander. **No Department member shall enter the building, other than the first-in crew, until ordered to do so by the incident commander.**

All truck companies now carry the Multiple-Gas meter for leak detection, as well as TIF meters. The meters are programmable multiple-gas monitors designed to provide continuous exposure monitoring of toxic organic and inorganic gases, oxygen, and combustible gases. The TIF meter detects the presence of combustible and/or flammable gases, but it does not give numeric readings, and can not be used to determine the explosive limits of any atmosphere where a leak is detected.

Most natural gas emergencies occur when a pilot light has gone out on an appliance (generally a stove), and/or the thermo coupling has failed on a water heater or furnace and the gas continues to flow. Shutting off the gas to the affected appliance can easily mitigate these conditions. In residential gas emergencies, these appliances should be considered and investigated first.

Ventilation shall be performed by vertical or positive pressure after the leak has been controlled and ignition sources eliminated. Fans (use large fans when available) shall be connected to an outside power source (generators, if necessary) and at **no time** shall fans be used in such a manner as to draw natural gas-contaminated air through them. Fans should be turned on before moving them into position.

After ventilation has been completed, meters should be used in the building to make a final check to ensure that natural gas is not present or limits are below...
10% LEL, and that carbon monoxide levels are acceptable (less than 9ppm in residential, 35 ppm in commercial).

IV. HAZARDOUS MATERIALS EMERGENCY RESPONSE TEAM (HAMER 1)

Hamer 1 is dispatched to all inside natural gas emergencies and major outdoor leaks. The incident commander may request the assistance of Hamer 1 at any natural gas incident. Hamer 1 carries a variety of meters as well as various plugs, patches, wedges, sealing materials, spark-proof tools, clamps, and proximity suits that may be utilized. The expertise of the members of Hamer 1, with the specialized equipment they carry, makes them an excellent choice as an entry team to locate and mitigate leaks.

This is especially true if the leak can not be shut down at the meter.

V. MAJOR OUTDOOR LEAKS

Orange plastic pipe is the predominant supply line used by Xcel Energy. This type of pipe may be crimped by the Hamer team in order to slow down a complete break. However, if a line is only cracked or partially broken but gas is still flowing through the supply pipe, where hazards permit, Xcel Energy asks that we leave it alone.

Another concern with crimping gas lines is the increased hazard of creating a spark when there is a “joint” or “combined” trench, containing an electrical line and gas line in the same trench.

It is important to remember that high amounts of static electricity are developed during the normal flow of gas through plastic piping.

Before making any attempt to crimp the pipe, wet rags must be wrapped around the leaking area to prevent a discharge of static electricity. In any type of large outside line break, it is better to secure the immediate and surrounding areas and wait for the assistance of Xcel Energy crews.

Larger lines, 6” to 10”, can not be plugged, and assistance from Xcel Energy is mandatory. No attempt shall be made to shut off the leak in a high pressure or large diameter supply line. The area shall be secured and nearby buildings should
be evacuated and sealed by shutting windows and doors. HVAC system air intakes may also draw gas into a building and may need to be shut off as well. A perimeter must be established where the gas limits are below 10% LEL. Exposures shall be covered by hose lines while Xcel Energy repairs the rupture or shuts down the supply.

If ignition has taken place, there shall be no attempt to extinguish the fire. Protect exposures from radiant heat by applying hose streams directly to the exposure building. Applying hose streams directly to a gas fire will not extinguish the leak, and will only hamper the efforts of Xcel crews.

During a large diameter, high pressure leak, members operating in the immediate area of the leak shall wear full PPE, including SCBA.
PURPOSE: To provide an understanding and working knowledge of the fundamental operations of the engine company and to serve as an introduction for the following engine company guidelines

SCOPE: Applies to all officers and Firefighters assigned to or working as a member of an engine company

The importance of a highly disciplined and well trained engine company can not be over emphasized. Arguably, one of the most important tasks to be accomplished on the fireground is the placement and effective operation of the initial hoseline. The engine company’s ability to quickly and effectively stretch and operate a hoseline most often determines the number of lives saved and subsequent fire damage prevented during fireground operations. Statistics show that fireground injuries and death are drastically reduced after the fire has been extinguished. The importance of placing the initial hoseline into operation and getting water to the seat of the fire can not be overstated.

The engine company officer sets the stage for the successful engine company through leadership and training with his/her crew. Upon arrival to the fire scene, the engine company officer is faced with a myriad of considerations that will ultimately affect a positive outcome for the incident at hand. For example, the officer must, in coordination with the Engineer, initiate appropriate apparatus positioning with considerations for water supply, responding ladder companies, attack line stretches, and potential fire spread. In addition, a proper size up of the incident should provide information regarding rescue situations (location and number of parties trapped), size and extent of fire, structural integrity, hoseline selection (length, diameter, nozzle), and the type of hose stretch most suitable, i.e. straight into the fire building, up or down a stairway, up a stairwell well hole, or potentially up the exterior of the building using a rope or over a ladder. Not to be disregarded is the engine company officer’s understanding of the abilities and limitations of the crew members present. The engine officer must recognize the skills and abilities present and use them to their greatest potential as members of the engine company team.

The engine company Engineer assumes the primary responsibility of the safe and efficient delivery of all members of the engine company to the emergency to which they are responding. In addition, the engine company Engineer must be proficient in their ability to provide the needed water and correct pressure through the necessary hoselines, as well as to ensure the completed water supply to the engine. The Engineer must be well versed in the hydraulic formulas and calculations necessary to provide the needed water flow to the various hoseline members operating inside the fire building. The engine company Engineer must also consider
the appropriate positioning of the apparatus, remain out of the way for operating truck companies, be cognizant of the potential needs for more water should the incident demand, and must also monitor their radio to remain aware of the actions occurring within the fire building itself.

The Firefighter/officer assigned to the nozzle position must understand the impact and importance of their task. The ability to recognize the appropriate time and location to apply the correct stream into the fire environment is a skill that comes with time and experience. An example of this would be the application of the stream into the overhead (and over-heated) atmosphere to cool the unburned fuel (smoke) present in order to prevent rollover and flashover situations. The nozzle Firefighter must be vigilant to changing fire conditions and be prepared to act aggressively with the appropriate stream placement and hoseline positioning. The rest of the attack team must also be cognizant of changing conditions such as fire spread or structural weakness, and be prepared to relay this information to the engine officer.

The back-up, or “Sampson” Firefighter, must be familiar with their respective engine so as to properly assist the officer with the initial hoseline stretch. In addition, the Sampson must be applied to the supply line to avoid flooding the hose-bed. This Firefighter is then charged with providing assistance to the officer who will be initiating the stretch and placement of the attack line. It is imperative that the utmost attention be paid to this initial stretch with regard to kinks and proper Firefighter spacing on the hoseline for efficient hose advancement. The experienced Firefighter will anticipate potential problems encountered at corners, doorways, and other obstacles during this advancement. It is imperative that the engine company members operating on a hoseline exercise discipline so as to not bunch up on the nozzle, but rather remain appropriately spaced out along the line to allow for the proper advancement of the hoseline throughout the fire building.

The Firefighter assigned to water supply must ensure that this task is completed in a timely and effective manner in order to quickly rejoin the rest of his/her company on the hoseline. If the water supply can not be established due to a bad hydrant, for example, this must be communicated immediately. In addition, the water supply Firefighter must be mindful of kinks in the supply hose which could severely hinder proper water flow at the incident. Kinks may be found at the hydrant due to the hydrant strap, under car tires or in the street on the way back to the engine. This Firefighter must exercise diligence and discipline to ensure the water supply is not compromised in any way. Once the water supply Firefighter has rejoined his/her crew, strict discipline must be exercised on the hoseline, assuming the necessary position at a corner or doorway, for example, to help get the hoseline into place effectively and efficiently.

As mentioned, the engine company member holds a very challenging and dynamic position that requires a thorough understanding of the capabilities of their specific engine, including the
different hose sizes and loads, nozzles, and all available tools found on that apparatus. A full and complete knowledge of the characteristics of the hose stream and the associated hydraulic theories are of prime importance in the study of the engine company member, as well as the appropriate techniques required to successfully get the initial hoseline in place as quickly and efficiently as possible. Pre-planning the different types of buildings found in their response area with regard to hose stretches and connections is the finishing touch to a well-rounded engine crew. Each and every member of the engine company must understand the importance of their specific roles and the contributions that they make to the team as a whole. These concepts are all accomplished through strong leadership from the engine company officer that emphasizes the importance of a thoroughly trained and disciplined engine company with highly skilled Firefighters.

Keep in mind the following are guidelines only. They do not replace good judgment, common sense, or a good initial size-up upon arrival on scene. The Standard Operating Guidelines for Engine Operations have been categorized into major fire incident types for the ease of reference. However, as a company officer, do not allow yourself to fall into the routine of thinking that each fire that you respond to falls neatly into one of these categories. Every house fire, commercial building fire, car fire, or any of the myriad types of fires that you will respond to has its own unique circumstances that you must recognize in order to make good, sound decisions. The choices of water supply, hose size, hose length, nozzle selection, where you place your line, and the placement purpose are all decisions that you are going to make and be responsible for. Those decisions are often going to be dictated by what you see when you arrive. You will find that the fire, its location, size, and potential to grow will dictate most of your actions. Pay attention! **These guidelines do not replace your good judgment!**

**REFERENCES:** None
Backup Line: This is a line that is at least as long (or longer) as and also has the capability of delivering the same gallons per minute as the primary attack line. This line will be charged with water, staffed by Firefighters, and can be put to use in any number of ways:

- Providing additional water support (gpm’s) for the attack line – water delivery to seat of fire
- Providing support in the form of protecting egress for the attack or search teams – i.e. positioning this line at the top of a stairwell to prevent the fire from coming from behind crews operating there
- Providing water delivery in the form of exposure protection – this can be an inside or outside exposure

Dual Reverse Lay: Dual reverse lays can be accomplished with two 3” supply lines laid from the attack engine, or multiuniversal or ladder/tower/truck back to the hydrant. The overall benefit is having the engine ‘going to work’ on the hydrant (this is imperative for adequate water supply for master stream applications). This technique can be used as a water supply system for a ground level master stream, ladder tower master stream, as well as water supply for a second engine involved in various fire attack measures. This system is also imperative for high-rise water supply operations.

Forward Lay: The engine company establishes a water supply by making a connection to the fire hydrant utilizing the Humat valve. This Engine shall make connections using one or two 3” lines (depending on the structure) and drive the apparatus to a location at or near the fire building, being mindful not to obstruct truck operations.

Going to Work on a Hydrant: This term applies to an engine working on a hydrant utilizing a 5” supply line. Some of the options for this source engine are:

- Pumping to an in-line engine in a relay set-up
- Pumping to an attack engine in a tandem set-up
- Pumping through a supply line wyed-off to an attack line (reverse lay)
- Pumping to a portable master stream device (monitor, blitzfire)
- When fire attack engine is located in close proximity (35’) of the hydrant

Humat Valve: A four-way hydrant valve that is designed to deliver an uninterrupted water supply via a forward lay. A subsequent engine can then go to work on this same hydrant and boost the pressure in the original 3” line laid by the attack engine or
add another 3” supply line to the equation and increase the water delivery two-fold.

**Master Stream Operations:** Master streams can be used in an offensive, transitional, or defensive operation, provided no crews are operating in the interior of the structure. Any time a master stream is needed, a water supply must be set up with a minimum of two 3” lines or one 5” line. The engine supplying the master stream(s) must be set up to ‘go to work on the hydrant’ to maximize water delivery to the master stream device(s).

**Relay Pumping:** The process of using two or more engines to move water through hoselines over a long distance by operating the engines in series.

Note: Pumping in relay is usually required any time the water source is located more than a few hundred feet from the fire. Relay pumping is nothing more than inserting fire pumps (engines) into supply lines at various intervals to counteract the effects of friction loss and/or an increase in elevation. Hose size and hydrant pressure are key factors to consider when deciding if a relay operation is needed.

Water discharged from the source engine is boosted and flows water through either two 3” lines (or more) or one 5” line to the inlet(s) of the next engine (in-line engine or attack engine). A residual pressure of 20 – 80 psi is to be maintained between source engines and subsequent engines thereafter.

**Source Engine:** Engine at work on the hydrant utilizing 5” hose for supply from the hydrant and delivering water to the next engine via two (or more) 3” lines or one 5” line. This engine will be pumping in volume (parallel) so as to maximize water delivery to the next engine.

**In-Line Engine:** Engine receiving water from the source engine and delivering water to another source engine or the attack engine via two (or more) 3” lines or one 5” line.

**Attack Engine:** Engine at or near the fire building receiving water from an in-line engine or source engine. This engine will be responsible for delivering water to multiple attack lines, a master stream device, or both. This engine will generally be in the pressure (series) setting, depending on the amount of water being delivered.
**Reverse Lay:** A reverse lay can be utilized for an interior attack, master stream operations, or for additional supply needs. The engine will lay from the identified objective to the nearest hydrant to “go to work” at the hydrant.

**Safety Line:** The purpose of the safety line is to have a readily available attack line at the point of entry for support, exposures, RIT operations, etc.

This line is pulled at a working fire and made ready to go at the same point of entry as the attack team. It will be left dry at or near the door until needed by responding crews. Generally this line is pulled by the attack engine Engineer after the water supply has been established. It can also be pulled by the RIT team or 2nd engine crew.

**Tandem Pumping:** A short relay operation in which the engine taking water from the supply source pumps into the intake of the second engine. The second engine boosts the pressure of the water even higher. This method is used when pressures higher than the capability of a single pump are required.

This method is commonly used when the attack pumper is located close enough to a hydrant for a forward lay, yet needs to overcome friction loss problems which occur in either large sprinkler or standpipe systems or long hose lays.

Tandem pumping is the method used by Denver Fire Department for all high-rise operations that involve pumping into a Fire Department connection.

The engine at the hydrant will utilize 5” supply and pump to the attack engine in volume ‘parallel.’ The attack engine will pump in either volume or pressure ‘series’ depending on the situation (high-rise, sprinklers, attack lines, master streams).

Standpipes/FDC – pressure
Sprinkler Connections – volume at 150 psi

**Water Supply Hose:** Water supply hose shall be either 3” or 5”. This applies to all operations that include pumping to an FDC. Engine companies should be discouraged from using 2-1/2” hose as a source of supply for delivering water via in-line pumping, to master streams, or to Fire Department connections.
USE OF THE HUMAT VALVE

Any time an engine company is dispatched to a reported structure fire or an odor investigation with smoke and a forward or dual forward lay is performed, the Humat (hydrant) valve shall be used.

The Humat valve can provide a key advantage to the overall water supply needs of the incident. Humat valves are designed to assist within a forward lay scenario from the hydrant to the fire area. The key advantage for the using a Humat valve is to provide additional GPMs and to assist with boosting pressure without having to interrupt the initial water supply to the attack engine.

SAFETY STRAP

The safety strap shall be utilized to secure the hose line at the hydrant while the engine is laying the supply line(s). The safety strap shall be inspected on a daily basis to ensure the structural components are intact and that they have not been compromised by chemical erosion or normal wear.

POSSIBLE CONSIDERATIONS FOR THE USE OF THE HUMAT VALVE

A. First engine secures a water supply with a single 3” supply line and Humat valve. The second engine goes to work on the same hydrant, but does not engage the pumps. The second engine simply allows the water to “pass through” the pumps as it is delivered to the first engine. This scenario may apply to a very strong hydrant at a fire that is not demanding many gpm (there have been instances of the second engine, just by placing the pumps in gear, to exceed what the first engine needs in terms of water – this scenario works well for those situations.) A second supply line is not laid between the engines.

B. Same scenario as above, but now hand lines are operating off of the first engine beyond what a single 3” line can give with straight hydrant pressure (also increasing gpm) being delivered to the first engine. The second engine engages the pumps and begins to increase pressure to the attack engine’s supply. This increase is sufficient to handle the water flow being asked for by the hand lines in service off of the first engine. A second supply line is not laid between the engines, but can be considered due to the increase in water demand and/or decreased hydrant capability.

C. The third scenario utilizes dual supply lines. The first in attack engine lays two lines to the fire area. One line would be charged from the hydrant via the Humat valve while the other lay dry for future use by the second or subsequent engine company. The second or
other subsequent engine company may conduct a reverse lay from the attack engine to the Humat valve or a hand stretch may be needed to complete the additional supply lines.

D. Multiple supply lines can be laid between the attack engine and the supply engine, provided that a Siamese or multiple Siamese appliances are used on the attack engine’s supply inlet.

Initially laying dual 3” supply lines in either a forward or reverse lay should be considered based on the size of the fire and type of building construction and the possibility that other responding apparatus may block future attempts for an engine to successfully lay additional lines. This congestion may cause the needed additional supply lines to be hand stretched to the area, thus delaying future water supply needs at a critical time in the incident.

All of these actions take much coordination from the engineers on the two engines involved. Both engineers must be attentive to radio traffic with regard to fire attack and water needs. In-district training and a method of communication should be developed by all engine engineers to ensure a safe and effective water supply evolution.
PURPOSE: To provide a guideline for Engine company operations at grass/weed fires with regard to life safety, property conservation, and incident stabilization.

SCOPE: Applies to all members performing Engine company operations at grass/weed fires.

Although limited, past history has demonstrated that the potential exists for rather devastating grass/weed fires within the City limits. The primary concern when confronting a grass/weed fire is the same as any fire – life safety and property conservation. Early recognition for the potential for fire spread, if any structures may be threatened, and whether the resources on scene can adequately mitigate the problem must be quickly determined by the first arriving officer. In addition, the request for additional resources, including mutual aid, should be made early on in the incident.

One of the first things to be considered when attacking a grass/weed fire is the flame lengths. Generally, flame lengths of four feet or less can be attacked from the head of the fire. When attacking from the head, the officer must be aware of fuels and wind conditions.

Prior to taking an engine off of a hard surface, the engine officer, with coordination from the Engineer, must ensure that the soil will support the weight of the apparatus. When applying water to the fire, consideration should be given to the use of foam. This will help with penetration of dense fuels. Foam can be applied in as low a concentration as 0.5%. A Blitz fire foam applicator is a valuable tool in this scenario, if available.

If flame lengths are greater than four feet, the officer should find an anchor point and work from the burned side toward the head of the fire. This tactic will require a pump and roll apparatus if the distance to the head of the fire is farther than the length of a hose lay. The officer must ensure that the fire is completely extinguished. This may entail using shovels to separate the burned from the unburned fuels.

Self contained breathing apparatus should not be worn unless conditions warrant. If wildland firefighting uniforms are available, they should be used. If structural bunkers are worn, the officer must closely monitor the crew for signs of heat injury.

REFERENCES: None.
PURPOSE: To identify operational tactics for safe and efficient removal of parties trapped from a motor vehicle

SCOPE: Applies to all engine company members operating at a parties trapped/extrication response

Parties Trapped / Extrication

A. Rig Placement
   Engines should park to allow access for incoming truck/tower/rescue companies and park in a manner that blocks the scene from oncoming traffic yet also allows close access for a handline stretch.

B. Water Supply
   A sustainable water supply from a hydrant should be considered if needed. If laying a supply line, traffic considerations must be taken into account with regard to vehicles running over the hose and causing a rupture.

C. Fire Attack
   The minimum line suitable for a parties trapped/extrication is a charged 1-3/4” handline with a minimum 125 gpm fog nozzle – at the ready and staffed by a Firefighter. This line should be one that has foam capabilities if coming off a rig with an on-board foam proportioner (pre-connected foam line). Due to unforeseen fuel leaks or other flammable hazards, having a foam stream ‘at the ready’ is paramount for a foam blanket and vapor suppression.

D. EMS
   Members of the first due engine are responsible for initial triage and medical assessment. Following the initial size-up and patient assessment, the IC shall contact Dispatch and request additional resources, if needed.

E. Extrication
   Physical extrication of patients should be well-coordinated between the engine and truck/rescue crews. Denver Fire Department is responsible for and in charge of all extrication activities. Once this has been completed, patient care is then turned over to on-scene ALS units for transport to a hospital.
If the extrication process will be lengthy, ALS members may be allowed access to the patient(s) for I.V. therapy and a quick assessment, if necessary. This activity will take place under the direct supervision of the on scene IC.

REFERENCES: None
PURPOSE: To identify operational tactics for safe and efficient extinguishment of motor vehicle fires

SCOPE: Applies to all engine company members operating at a motor vehicle fire. Also included are members of truck/tower/heavy rescue companies that are dispatched to aid in the extinguishment, forcible entry, or search of these vehicles.

Motor Vehicle Fires

A. Fire Control Operations

A motor vehicle fire should be treated as a ‘mini house’ fire in the scope of duties to be performed by responding fire crews. Fire attack, forcible entry, primary search, and ventilation are all tasks that need to be performed by the arriving engine crew. Having members fully prepared to handle these duties by wearing PPE and SCBA will ensure a successful operation, with fire safety in mind.

The minimum level of protection for Firefighters is full protective clothing (PPE) while breathing air from an SCBA. While engaged in pump operations, the Engineer is not expected to wear full PPE. Officers have discretion as whether to wear PPE with SCBA, but if they are engaged in any firefighting efforts, PPE with SCBA should be worn.

The minimum size hoseline for a working auto fire is the 1-3/4” handline with a constant gallonage fog nozzle capable of flowing a minimum of 125 gallons per minute (gpm). If using an on-board foam proportioning system (i.e. Pierce Engines), the previously recommended 95 gpm foam nozzle should be avoided as it will not produce an adequate foam stream.

B. Apparatus Placement

Apparatus should be placed upwind and uphill of the incident, if applicable, to afford protection from hazardous liquids and vapors, and also to reduce smoke exposure for the Engineer.

Consideration should also be given to using the apparatus as a barrier to shield the incident from traffic hazards. Warning lights should be left operating with the use of traffic cones, if necessary. The use of road flares is discouraged due to the possibility of ignition of flammable vapors.
C. Water Supply
If the water carried on the engine will not be sufficient for extinguishment, early consideration must be given to additional water supply sources. Securing a water supply (hydrant) is a viable option, provided one is available and traffic considerations coincide with a supply line being laid out. Another consideration is calling for an additional engine company, especially for auto fires on the highway/freeway, where hydrants are limited, or if the size of vehicle will demand more water for fire attack. There are highway/freeway standpipes and hydrants available for use, and these should be pre-planned, noted, and trained with for use by companies having them in their district.

D. Fire Attack
Where parties are trapped in the vehicle, water should be first applied to protect the patients and permit an effective rescue.

Due to the possibility of a fuel system leak or rupture, or in the event of an active fuel leak or fuel spill, the attack line of choice should be the 1-3/4” handline with a minimum of a 125gpm fog nozzle having the capability of immediately putting foam to work (pre-connected foam line).

If foam is used, the setting should be proportioned at the 6% foam discharge setting. This is the recommended setting for E85 Ethanol-based fuel and will work well for other types of vehicle fuel mixtures.

When rescue is not a factor, initial water should first be applied for several seconds to extinguish fire or cool down the area around any fuel tanks or fuel systems. This is especially important if the fuel tanks are Liquefied Petroleum Gas (LPG) or Liquid Natural Gas (LNG).

One member of the attack team, in full PPE with SCBA, must have forcible entry tools in his/her possession to provide prompt and safe entry into the vehicle.

E. Firefighter Approach
The attack approach to a vehicle fire should be one that avoids direct approach from the front of the vehicle and one that avoids close contact with any tire that is directly affected by fire. Some vehicles today have front bumpers that are attached by two shocks encases in a metal housing
-- known as \textit{energy absorbing bumpers}. When heated by fire, these shocks will develop high pressures, heat up, and may explode, causing the front bumper to become a projectile that may seriously injure a Firefighter. Bumper assemblies have been known to travel 25 feet. A tire or split rim that is in close contact to or being exposed to flame impingement may also become a projectile if overheated.

Sufficient cooling of these two areas with water is needed prior to engaging in any activity that may put Firefighters in their path (i.e. prying open the hood of the vehicle for engine access).

Of special consideration are the gas-filled struts, springs, cylinders, extending arms that hold the hood open and extend the rear hatch-back doors open. If overheated, these struts will also explode and become projectiles capable of serious bodily injury. Sufficiently cooling these struts with water will minimize the danger of explosion and subsequent release. To ensure personal safety, be sure to allow sufficient clearance when releasing latches.

F. Hybrid Vehicles

Most recent publications recommend treating a gas hybrid car fire much the same as a fuel-only-driven auto, with a few special considerations.

The tool of choice is copious amounts of water, which will both eliminate the radiant heat and also cool the hybrid’s metal battery box and the plastic cells inside the battery pack.

Hybrid vehicles by nature are extremely quiet when stopped and may appear to be off when, in fact, they are still running. Shutting the engine off and disconnecting the vehicle’s 12-volt battery will minimize electrical and fuel-related hazards.

Hybrid cars have orange cables that designate high voltage. Avoid cutting or disconnecting these cables.

\textbf{REFERENCES:} None
PURPOSE: To efficiently and safely Locate, Confine, and Extinguish (LCE) a fire in a single family dwelling

SCOPE: Applies to members performing engine company operations at a single family dwelling

Any time an engine company is dispatched to a reported structure fire or odor investigation with smoke and a forward or dual forward lay is performed, the Humat (hydrant) valve shall be used.

Residential Fire Operations – Engine Company

The first arriving engine to a residential house fire will establish a water supply. If a forward lay is performed, a Humat valve shall be utilized.

The second arriving engine to a residential house fire will establish a secondary water supply or augment the first arriving engine by ‘going to work’ on their hydrant (Humat valve). If gaining a second water supply, this supply line should be laid to the rear of the residence. A Humat valve will also be used by this company.

It is strongly discouraged for the second engine to lay to the front of an address if there is already an attack engine at or near the front of the fire building, due to spotting considerations for the first and second due truck/tower companies. It would be more appropriate for this engine to go to work on the hydrant/Humat valve of the first attack engine.

If the second engine can not lay to the rear (there is no alley), then this engine should augment the water supply of the first attack engine at the Humat valve.

The third arriving engine (if not pre-assigned as the RIT company) should consider going to the rear of the fire building or going to work on the attack engine’s Humat valve, if not already done. Fire conditions and I.C. discretion will dictate the best placement for this apparatus.

At a minimum, this third engine officer should be thinking of a second water supply or augmenting the water supply of the attack engine.

REFERENCES: None
PURPOSE: To efficiently and safely Locate, Confine, and Extinguish (LCE) a fire in a multi-family dwelling

SCOPE: Applies to members performing engine company operations at fires in multi-family dwellings

Fires in multi-family dwellings present a wide range of unique challenges to the engine company. Multi-family dwellings cover an extremely wide range of buildings found within the City and County of Denver, ranging from triplexes to lofts to expansive apartment complexes. These may all be of different construction type, and all will certainly require different approaches with regard to firefighting efforts. The engine company officer must consider the need for water supply (including potential standpipe operations), potential rescue situations, initial handline placement, and apparatus placement. In addition, the layout of the apartment building or complex, the building construction type, and the time of day are considerations that should occur during the size-up by the engine officer. It should be noted that many of today’s newer multi-family dwellings are actually older commercial occupancies, and considerations must be made for the differences in the approach to the diversity of these occupancies (see Engine Company Operations at Commercial Buildings SOG).

The first arriving engine company to a fire in a multi-family dwelling will either establish a water supply through a straight lay (utilizing the Humat valve), reverse lay, or make the appropriate connections to the building’s FDC. A water supply should be established in such a way to anticipate water needs, based on the size and construction of the occupancy and the potential for fire spread. Based on size-up, this would include laying one or two 3” supply lines. If a straight (forward) lay or dual forward lay is performed, a Humat valve shall be utilized.

The responsibility of second arriving engine company to a fire in a multi-family dwelling will be to either establish a secondary water supply or augment the first arriving engine by ‘going to work’ on their hydrant utilizing the Humat valve. If the occupancy is standpipe equipped and the first arriving engine company has made the appropriate FDC connections, the second arriving engine company will need to complete the water supply through tandem pumping. If the occupancy is not standpipe equipped and the second arriving engine opts to establish a secondary water supply, this engine company should lay to a different area of the building than the first engine where their position will be advantageous to fire attack or support operations. Water supply guidelines shall also be followed by this engine company.

The third due assigned engine company (if not pre-assigned as the RIT company) should be proactively considering going to work at the hydrant of either the first or second arriving engine
company or, if applicable, securing a second water supply and providing the use of their engine and handlines at a different location of the fire scene. Care must be exercised to avoid opposing handlines. The best location for the third due engine should be coordinated through Command upon arrival at the incident.

For obvious reasons, certain variances with unique apartment complexes and individual buildings throughout the City may dictate a different approach to the initial engine company operations. Variations from these guidelines must be communicated to incoming companies to allow them to adapt appropriately, especially to second and third due engine companies for subsequent water supply considerations.

Handline selection and placement is often a very dynamic decision-making process, based on the size and type of occupancy and amount of fire involvement. Engine members getting the nozzle to the seat of the fire for extinguishment may save more lives than effecting early time-consuming rescues. If rescues are in progress, the first handline may be deployed to protect egress of potential fire victims. This would include interior stairways, hallways, and common doors that may be used by civilians and firefighters for escape.

As previously mentioned, if the building is equipped with a standpipe, connections should be made to the FDC. However, if the fire is on the first floor or a lower floor, or the standpipe has proved itself inoperable, consideration should be given to an alternate method of getting a handline in place. The best method for this may be for a handline to be stretched into the front, side, or back entrance and directly to the fire room. However, certain situations may dictate that the handline be taken up stairs or up the exterior of the building. An example of this situation would be a low-rise apartment building, where no standpipes are available. A fire on an upper floor may necessitate that the line be brought up the exterior of the building, possibly into a neighboring apartment, over a balcony, or through a window. This may be done via ladders or by dropping a utility rope and pulling the uncharged handline up and into position. Interior stairwells may allow for a well-hole stretch. It should be noted that whenever hose is stretched vertically, it should be secured so as not to stress the coupling connections and to not allow the dry hoseline to fall back down once it is charged with water. These aforementioned situations are best executed when the engine company has preplanned and made themselves familiar with unique characteristics found in their first in occupancies.

Apparatus Placement
Apparatus placement will set the stage for successful operations by allowing incoming truck and tower companies access to the building for rescues and potential elevated master stream use. Many apartment complexes in the City have limited access to the buildings, and preplanning and forethought are required to allow for appropriate apparatus placement.
Throughout the City, one may find a varied collection of differing types of multi-family dwellings. They may actually be composed of any of the five construction types, dictating potential differences in the strategies and tactics implemented at the fire scene. Engine companies should use every possible opportunity to familiarize themselves with the buildings in their areas, paying close attention to FDCs, hydrant location, and the construction types.

REFERENCES: None
PURPOSE: To efficiently and safely Locate, Confine, and Extinguish (LCE) a fire in a commercial building

SCOPE: Applies to members performing Engine company operations at commercial building fires

Commercial Fire Operations – Engine Company

It must be recognized that there are dramatic and significant differences in size, type, and construction of commercial structures. Therefore, the water supply decisions of the first and second due engines will set the stage for a successful fire attack operation. Engine companies must recognize the increased fire load (greater BTUs) presented by a commercial building and make early water supply decisions that will be sufficient to supply multiple handlines, tower/ladder monitors, or ground monitors, if necessary. Laying a single 3” supply line to a large commercial structure will not be sufficient if additional water is immediately needed. There will then be a delay in the fire-fight as companies regroup to set up a larger water supply as the incident progresses. Be cognizant of the potential fuel load these buildings have to offer, and be ready for it!

The commercial structures that are typically found in the downtown area and central portions of the City of Denver (the City) have much smaller areas and construction is either ordinary or heavy timber. Newer commercial structures have extremely larger areas and are of pre-stress slab construction. Other buildings discussed here are found throughout the City and will pose water supply and fire attack issues due to their size and layout.

A. Apparatus Placement

Engine placement should be based on three agendas:
1. The engine must be out of the way for arriving truck/tower companies. Good aerial ladder placement is a must at these buildings, and every effort should be afforded the truck/tower to spot as close to the building as possible. “I can stretch a line but I can’t stretch a ladder” is a quote that directly applies to this concept.
2. Rigs should be out of any collapse zone hazards.
3. The engine should be close enough to stretch attack lines into the building.
B. Communication
Communication between engine officers with regard to water supply activities is paramount to a successful operation at commercial buildings. For example, stating where hydrants are, whether a reverse or dual reverse is needed, and whether you have laid in or not are all things that need to be expressed for a successful water supply evolution.

C. Water Supply
Every commercial building poses different water supply problems. Engine officers will need to think ‘outside the box’ in terms of water supply. A dual forward lay may not be appropriate in a massive warehouse or school. Finding the fire, then communicating the need for a dual reverse lay from the second due engine may be the appropriate tactic. Due to relatively longer lays and an increased need for water because of building size, early care must be taken with regard to an efficient water delivery system. Engines communicating their needs and actions will make this operation successful.

D. Traditional Style Commercial Buildings
Every effort should be made to lay two 3” lines to a traditional style commercial building by the first arriving engine company. If the building has a sprinkler system, every attempt should be made to augment it while the initial fire attack is started. Fire attack, due to materials involved and size of structure, should be made with the appropriate handline unless a large volume of fire dictates a ground master stream. Most traditional style commercial buildings are conducive to reasonable handline stretches (300’ or less).

It must be recognized by the first arriving engine officer that entry to the fire area may not be through the so-called “front entrance” where the office area is usually located. Typically, these buildings have office areas in front, and making the stretch from this point would be cumbersome and slow, and could hinder the fire attack. Entry through the actual warehouse (man-door or large roll-up door) may be more beneficial.

Special Consideration:
A truck/tower company using a tag-line system may have to do initial reconnaissance to locate the fire prior to hose lines entering the structure. This will save much needed time and energy by avoiding stretching an attack line to the wrong location.
E. Buildings with Tilt Up Concrete Slab Walls and Lightweight Construction Roofs
Once the fire area has been discovered, communication must be made with the engine officer to get an exact location for access with the rig and an attack line. Hydrant lays to certain points of these buildings may be in excess of one thousand feet. These types of distances are not conducive to a good water supply, especially when considering a single straight lay without hydrant augmentation by a second engine. The closest possible hydrant must be considered in order to establish a good water supply that may eventually involve master streams or, at the very least, multiple 2-1/2” handlines.

First arriving engine officers must strongly take into account how long it is going to be before they will benefit from the added help (in pumping) from another engine company. This is crucially important when considering a long straight lay. Extended straight single lines will not give adequate water supply for an initial fire attack. Therefore, this engine must consider the reverse lay or double reverse lay to get the engine to the hydrant and maximize the water delivery. Working on a hydrant is the most efficient place for an engine. The sprinkler system can also be augmented from this engine using this method.

It has been noted that many tilt up concrete slab with lightweight truss buildings have standpipe systems. This is incorrect; they are not standpipe systems, but are small hose connections (1-1/2 outlets piped into the sprinkler system) that are only meant to be used for “clean up” or overhaul lines. These small hose connections are not placed in a uniform manner within structures and are not required in all occupancies. Also, these connections are not required to be located near an exit as is required for standpipe connections. Due to all these variables, small hose connections shall not be used to supply an attack line.

Special Consideration:
Engine officers must recognize the need for immediate ground level master streams versus handlines in the fire attack due to the volume of fire present. This method can be most easily accomplished with the engine at the hydrant.

To be Noted:
Engine officers should always consider varying methods of water delivery to a commercial building. A straight lay with one 3” line is a risky venture given the fuel load and excessive friction losses with potentially long supply and attack line stretches. Ground level master streams are an excellent tool for delivering large quantities of water to the upper areas of most commercial buildings. This method can only be accomplished with an engine at the hydrant delivering water to the master stream via two 3” lines or one 5” supply line.

F. Schools/Churches
Coordination between engine officers is important at these buildings. Many standpipe systems in schools may not work, as they may only supply certain portions of the building or may only supply the sprinkler system. Engine companies should consider investigating the fire to find the best location for apparatus placement (this may not be at the front of the building). A second engine may have to lay a dual reverse supply line to the attack engine. The attack crew may then have to make its own standpipe system utilizing 2-1/2” as a supply from the engine. The high-rise backpacks are an excellent choice for an attack line here as they are portable and can be carried to a location near the engine-made supply, then stretched to the seat of the fire.

The high-rise hose packs can also be dropped from an upper floor to a waiting supply line and be put to immediate use in a fire attack. If the high-rise backpacks are not used, dropping a rope from an upper floor and hoisting sufficient hose into play will work.

Consideration will have to be given to supplying the sprinkler system if one is present. Understanding the building and its water systems through pre-plans will help to address this issue.

G. Lightweight Constructed Buildings
Lightweight constructed buildings (i.e. strip malls, stand-alone fast food restaurants) pose a serious hazard in their construction make-up. Lightweight constructed supporting members can fail in less than four minutes when exposed to fire. The engine company should be prepared to make use of this time to mount an aggressive interior fire attack, with the focus being water application on these supporting structural members.
Water supply is paramount and 2 – 3” lines should be considered as a minimum for the attack engine, with the second engine augmenting the attack engine by ‘going to work’ on the attack engine’s hydrant.

Line selection is paramount – heavy fuel load must be considered!

2-1/2” handlines and/or ground monitors should be considered based on fuel load, fire conditions, and location of fire. Once inside the building, opening up the ceiling with a solid/straight stream to cool the upper supporting members and also to stop fire travel is an excellent tactic due to relatively little roof compartmentation in these buildings.

If heavy fire is present upon arrival in one business, exposure protection to the adjacent or connected businesses may be more important. Gaining access to the exposure businesses and opening up the ceiling (truck crew) with a hoseline at the ready to cool the ceiling members will stop fire spread beyond the primary fire area.

REFERENCES: None
PURPOSE: To provide, through the correct placement and operation of the 5-inch engine, large amounts of water (in excess of 1,000 gpm) for master stream application

SCOPE: Applies to all members working on a 5-inch engine company performing large water operations through the use of 5-inch hose

I. MULTIPLE ALARM WATER SUPPLY OPERATIONS FOR 5-INCH ENGINE COMPANIES

The Denver Fire Department Incident Response Matrix includes the response of two 5-inch engines and one ladder tower to every multiple alarm fire. When used effectively, 5-inch engine companies have the ability to provide up to 2000 gallons per minute for the purpose of water supply to master streams. Often times they will use hydrants that will be more remote from the incident than those hydrants being used by the first responding engines. The reason for this is twofold. First, most of the close-in hydrants will likely have already been secured by first alarm engine companies. Second, and most importantly, the 5-inch engine company should attempt to locate and use a hydrant that is on a large water main. The reason for this is to maximize the amount of water that can be delivered from this large main, through the use of 5-inch hose, to the master streams that are operating on the fire scene.

II. FIRST ARRIVING 5-INCH ENGINE

While responding to a multi-alarm fire, the officer and crew on the responding 5-inch engine company should attempt to gain a mental picture of the following important items:

A. Location of master stream(s) to be supplied
B. Hydrants already in use by first arriving engines
C. Location of closest large water main

Once the master stream location is determined, the 5-inch engine should reverse lay their 5-inch hose from the master stream (ladder tower, ladder, or engine supplying a particular master stream device) to the hydrant that has been selected and ‘Go to Work at the Hydrant.’
Often times it might be necessary to spot your engine at the hydrant and hand drag the 5-inch hose to the master stream. This can be highly beneficial at building complexes or incidents that have poor vehicle access.

III. SECOND ARRIVING 5-INCH ENGINE

If the master stream is a ladder tower, it should be noted that there is approximately 100 pounds of friction loss in the water pipe alone. Straight ladders with no tower have 60-plus pounds of friction loss. This, added to the 80 pounds of nozzle pressure plus any head pressure, might make it necessary to put the second arriving 5-inch company right next to the ladder tower or ladder so as to receive the water from the 5-inch company at the hydrant and then augment the pressure and relay pump into the master stream.

The Incident Commander might prefer that the second arriving 5-inch engine be used to supply another, more remote master stream. This engine company should then simply follow the same operation outlined for the first arriving 5-inch engine.

To be Noted: All 5-inch engines should make every attempt to pay close attention to their radios and firehouse monitors when large structure fires are in progress. This might give them a better idea as to which hydrants are already in use and location of master streams.

Fire Dispatchers should also give 5-inch engines a “heads up” on the telephone when they suspect that a structure fire is advancing toward a multiple alarm fire. 5-inch engine companies can then start to ‘pre-plan’ a particular incident with regard to water supply. This is especially beneficial at night.

REFERENCES: None
I. INTRODUCTION

The amount of foam carried on Pumpers designated as foam rigs will be six 5-gallon cans. Engines with pre-connected foam tanks will carry foam supplies as prescribed by Operations.

II. PROCEDURES

A. Company Officer

1. Orders supply line laid out where possible and spots pumper at desired location for attack (up wind and up hill if possible.)

   Safety Precaution: Use all protective clothing and equipment, including helmet, bunking coat and pants, boots, gloves, SCBA, and hood, if issued.

2. Size up the incident to determine the quantity of foam and the type of foam needed by using the following rule of thumb:

   Polar solvents (acetone, ethanol): 5-gallons of AFFF/ATC set at 6% for polar solvents will cover 400 square feet. For oxygenated fuels, up to 30% additive or hydrocarbon 3% setting on meter valve will cover 800 square feet. The general rule of thumb for foam depth is ½ to 1 inch.

   The foam blanket should be white in color. Reapply often to maintain the color.

3. If the I.C. does not have the resources available to handle the incident, he or she should call for help and reevaluate the situation. If it is determined that the necessary resources are available to control the situation, this procedure should be continued.

   See page on Foam Application Rates for a Spill.

B. Company Member
1. Makes hook up of eductor. Eductor can be mounted directly to pumper outlet or extended as needed with a 2-1/2 inch supply line from pumper to eductor position.

2. Metering valve must be set at the correct percentage settings according to the type of foam carried and its use. (Check the foam cans that are on your pumper for the correct percentage setting for the eductor.)

C. **Company Officer**

Order lengths of attack line, up to 300 feet of 1 ¾ inch hose from the eductor to the incident scene.

D. **Company Member**

Pulls desired size and length of hose and makes connections to the eductor.

E. **Company Officer**

Selects the proper nozzle according to GPM flow. Nozzle GPM must match eductor GPM. All eductors flow 95 GPM.

NOTE: "The Elkhart Selecto nozzle should not be used."

A constant flow nozzle that has been set at 95 GPM is the best nozzle to use. At this time, the Akron Marauder is the nozzle of choice.

F. **Company Member**

Unload the six cans of AFFF/ATC from the trough.

G. **ENGINEER**

Puts pump into operation, 200 psi must be maintained at the eductor. The eductor siphon tube is placed in the first can. All caps should be removed from other cans at the same time for quick transfer of the siphon tube as the contents of the cans are removed.
H. **Company Officer**

Makes sure no kinks are in the attack line and checks to see that the nozzle bale is in the full open position.

NOTE: Shaper tube is designed for Elkhart Selecto nozzle and will not fit any other nozzles.

I. **Company Members**

Assist on attack line.

J. **Company Officer**

Directs the foam application, through one or more of the following methods:

1. **Indirect application:** splashing foam off a vertical surface is an efficient means of application.

2. **Bounce and roll** the foam onto the fire from the front to control a spreading surface fire.

3. **Raining the foam** in on a high soft arch. The AFFF/ATC should be continuously applied even after extinguishment, until that entire fuel surface is covered by a visible foam blanket, especially when firefighters must enter the spill area.

NOTE: The foam blanket should be reapplied every five to ten minutes to assure vapor suppression. Check the color of the foam blanket to make sure it is white. If the color turns brown, reapplication of foam to the area is necessary.

### III. CHECKLIST

The inability to properly proportion foam concentrate may be the result of one or more of the following:

A. **Mismatched eductor/nozzle combination**
B. Partially closed nozzle
C. Clogged nozzle
D. Hose lay too long
E. Metering valve closed
F. Nozzle elevated too high above eductor
G. Equipment clogged with dried foam
H. Ball check valve stuck
I. Plugged screen
J. Kink in hose

IV. FOAM APPLICATION RATES

FOAM APPLICATION RATES FOR A SPILL

HYDROCARBON (Gasoline)

\[
\text{AREA} \times \text{APPLICATION DENSITY} = \text{FLOW RATE REQUIRED}
\]

Flow Rate X 10 Minutes X% Concentration – AFFF/ATC needed.

1,500 Sq. Ft. 0.10 GPM/Sq.Ft.

1,500 FPM X .10 = 150 GPM Flow Rate Required.

150 GPM X 10 Minutes = 1,500 Gallons total foam solution required.

1,500 Gallons X .03 (3% concentration) = 45 Gallons AFFF/ATC proportioned at 3%.

This example indicated that a minimum water flow rate of 150 GPM is required with 45 gallons of AFFF/ATC proportioned at 3%.

POLAR SOLVENTS (ACETONE, ETHANOL)

\[
\text{AREA} \times \text{APPLICATION DENSITY} = \text{FLOW RATE REQUIRED}
\]

Flow Rate X 10 Minutes X% Concentration – AFFF/ATC needed.

1,500 Sq. Ft. .20 GPM/Sq. Ft.

1,500 XX .20 = 300 GPM Flow Rate Required

300 GPM X 10 Minutes = 3,000 Gallons total foam solution required.
3,000 Gallons X .06 (6% concentration – 188 gallons of AFFF/ATC proportioned at 6%.

This example indicates that a minimum water flow rate of 300 GPM is required with 188 gallons of AFFF/ATC proportioned at 6%.

V. COLD WEATHER OPERATIONS

COLD WEATHER OPERATIONS WITH AFFF (LIGHT WATER & AFFF/ATC)

The AFFF/ATC concentrate that the Denver Fire Department is using is good at temperatures of 25 degrees Fahrenheit to 120 degrees Fahrenheit. Below 25 degrees, the concentrate is too thick to siphon, and over 120 degrees the concentrate is too thin to siphon.

Possible Solution:

If the temperature is below 25 degrees Fahrenheit, put one or more sections of hose on the ground near the exhaust pipe of the pumper. Next put the five-gallon AFFF/ATC container on the hose. The exhaust will help keep the AFFF warm and ready for use. Also, you might cover the AFFF/ATC cans with a tarp to hold in the heat.

CAUTION: Make sure the exhaust does not melt the plastic cans.

Problems on your Eductor:

There is a small brass ball check valve in the eductor. If any moisture is in this valve, it can freeze to the seat and cut off the AFFF/ATC.

Solution:

Try to keep the eductor warm until the last minute before using.

Another Possible Solution:

1. Check the water level in the tank. (You might have to drain 30 gallons of water out of the tank first, then add 30 gallons of AFFF/ATC.)
2. Dump six cans of AFFF/ATC into a 500-gallon tank.
3. Pump at any layout needed for the fire.
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Section: OPERATIONS: ENGINE OPERATIONS
Topic: AFFF / ATC FOAM

4. After returning to quarters, the water tank and pump should be thoroughly flushed out to remove all foam residue.

VI. OXYGENATED FUELS

A. Alcohol

Color: Clear, colorless to dark colored liquid
Flash point: Less than 100 degrees F
Weight: Lighter than water, generally soluble in water
Vapors: Heavier than air
Extinguishing Agent: AFFF/ATC, carbon dioxide, dry chemical
Personal Protection: Avoid breathing vapors
Keep upwind
Wear protective equipment and SCBA

B. Ethanol – Ethyl Alcohol

Color: Colorless liquid
Flash point: 58 to 60 degrees F
Weight: Heavier than air
Extinguishing Agent: AFFF/ATC, carbon dioxide, dry chemical
Personal Protection: Avoid breathing vapors
Keep upwind
Wear all protective equipment and SCBA

C. (MTBE) Methyl Tertiary Butyl Ether – Butyl Ether

Color: Colorless liquid
Odor: Turpentine-like odor
Flash point: -30 degrees F
Weight: Lighter than water, insoluble in water
Vapors: Heavier than air
Extinguishing Agent: AFFF/ATC, carbon dioxide, dry chemical

Personal Protection: Avoid breathing vapors
Keep upwind
Wear all protective equipment and SCBA
DENVER FIRE DEPARTMENT

STANDARD OPERATING GUIDELINE

Topic No: 2113.01
Date: 04-20-11
Approved: TAB
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Section: OPERATIONS: TRUCK OPERATIONS

Topic: Truck Company Operations at Single Family Residential Fires

PURPOSE: To provide a procedural overview for first and second arriving truck companies

SCOPe: Applies to all Denver Fire Department personnel functioning in an operational capacity at a single family residence fire

OPERATIONS
All Truck company duties are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander.

I. FIRST IN TRUCK COMPANY RESPONSIBILITIES

A. Size up
B. Rig placement
C. Establish Command (if no Chief on scene)
D. Forcible entry for initial attack line placement
E. Search and rescue
F. Utility control
G. Check for extension
H. Salvage and overhaul
I. Ventilation

II. ROLES OF THE FIRST IN TRUCK

A. Officer
1. Size up
2. Officer establishes Incident Command and builds the command structure as the situation dictates and available resources allow.
   a. Brief command statement
   b. First in tactical assignments
      i. Rig placement and assignment for second in truck and other responding apparatus
      ii. Request additional resources and make other assignments as necessary.
   c. When relieved of command, rejoin the Engineer for interior search and rescue or further fire ground operations.
B. Engineer
   1. Rig placement, spot for the building
   2. Check for presence of fire conditions in basement windows.
      a. If fire conditions are present, notify command immediately.
      b. Horizontal ventilation is appropriate.
   3. Rear door sweep
   4. Utility control
   5. Vent as appropriate.
   6. Report to command on c-side conditions and actions taken.
   7. Rejoin the officer for further fire ground operations.
   8. Check for extension.
   9. Salvage and overhaul

C. Firefighters
   1. Force entry for primary attack line.
   2. Search for victims and the seat of the fire.
      a. Concentrate efforts on exit passages and bedrooms.
      b. Relay the location of the fire to attack crew.
      c. Report the results of the primary search to command.
      d. Begin a secondary search.
      e. Report the results of the secondary search.

All members must operate in the rescue mode until all secondary searches are completed.

III. SECOND IN TRUCK COMPANY RESPONSIBILITIES

Priority is dictated by the situation and needs to remain flexible, but may include:

A. Complete unfinished primary tactical responsibilities.
B. Vent Enter Search (VES)
C. Primary search of the floor above the fire
D. Roof operations
E. Laddering for rescue, access/egress, and vertical ventilation
F. Force barred windows
G. Vent for life
H. Vent for fire
I. Positive pressure ventilation
J. Check for extension
K. Check exposures
L. Salvage and overhaul

IV. **ROLES OF THE SECOND IN TRUCK COMPANY**

These are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander and the second in truck officer.

**REFERENCES:** None
PURPOSE: To provide a procedural overview for first and second arriving truck companies

SCOPE: Applies to all Denver Fire Department personnel functioning in an operational capacity at low rise apartment fires

I. OPERATIONS

All truck company duties are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander.

II. CONSIDERATIONS

These types of fires differ from others due to the high life hazard and the enclosed multiple exposures within a single structure.

A. High life hazard
B. Limited apparatus and aerial access
C. Delayed operation of initial hand lines
D. Location of the fire
E. Standpipe, sprinkler, communication, Firefighter “B” service elevators, and centrally monitored alarm systems may not be present.
F. Uncontrolled smoke exposure
G. Protect occupants in place or evacuate
H. Multiple exposures
I. Stacked utility chases
J. Large combustible attics or cocklofts
K. Auto exposure

Assume these structures are lightweight construction until confirmed otherwise. The presence of fire within the lightweight structural components and voids must be relayed to command.

Depending on height, construction, and aerial access, these structures may be treated like high rise fires.
Initial investigation must start at the lowest level to confirm that the fire did not originate on a lower level and vent up through open fire doors, stairways, and open apartment doors.

First and second in truck placement is critical; Engineers may be required to stay with the apparatus and operate the aerial.

Locating and rescuing the most endangered occupants and confining the fire must be a priority. Aggressive smoke control and ventilation of stairwells and hallways are critical for life safety. Roof operations are crucial to assist with smoke control and to prevent fire spread throughout the combustible voids.

Incident Commanders should consider calling for additional resources early.

III. FIRST IN TRUCK COMPANY RESPONSIBILITIES

A. Size up
B. Aerial placement
   1. Spot for rescue and roof operations
   2. Communicate placement for second truck
C. Establish command
D. Locate the fire
E. Forcible entry for initial attack line placement
F. Search and rescue starting from the fire apartment working outward and upward
G. Utility control, initially within the affected apartment
H. Check for extension
I. Salvage and overhaul

IV. ROLES OF THE FIRST IN TRUCK

A. Officer
   1. Size up
   2. Officer establishes incident command and builds the command structure as the situation dictates and available resources allow.
      a. Brief command statement
      b. First in tactical assignments
DENVER FIRE DEPARTMENT

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Section: OPERATIONS: TRUCK OPERATIONS

Topic: Truck Company Operations at Low Rise Apartment Fires

1. Rig placement and assignment for second in truck and other responding apparatus
2. Request additional resources and make other assignments as necessary.
3. Identify and communicate critical construction features such as interior or exterior hallways or walkways, balconies, or other refuge areas.
   c. When relieved of command, rejoin the Engineer or crew for further fire ground operations

B. Engineer
   1. Rig placement, spot for rescue and/or roof operations
   2. Aerial operations, if needed
   3. Rejoin the officer or crew as directed
   4. Utility control, either localized or general
   5. Indicate ventilation
   6. Check for extension
   7. Salvage and overhaul

C. Firefighters
   1. Locate the fire, searching from the lowest level and working up. Report conditions, actions, and needs.
   2. Force entry for primary attack line.
   3. Search for victims and the seat of the fire.
      a. Concentrate efforts on exit passages and bedrooms.
      b. Relay the location of the fire to the attack crew and Incident Commander.
      c. Report the results of the primary search to command.
      d. Conduct a primary search of adjacent apartments.
      e. Conduct secondary searches.
      f. Report the results of all searches.
   4. Ventilate as appropriate.
   5. Check for fire extension aggressively and early, concentrating on voids and utility chases.
   6. Salvage and overhaul

All members must operate in the rescue mode until all secondary searches are completed.
V. SECOND IN TRUCK COMPANY RESPONSIBILITIES

Priorities are search of the living unit(s) and floor above the fire or roof operations.

A. Spot aerial for rescue and roof operations, complementing the first in truck position.
B. Complete unfinished primary tactical responsibilities.
C. Primary search of the living unit(s) and floor above the fire
D. Roof operations
E. Laddering for rescue, access/egress, and vertical ventilation
F. Vent for life.
G. Vent for fire.
H. Positive pressure ventilation
I. Utility control
J. Check for fire extension aggressively and early, concentrating on voids and utility chases.
K. Check exposures.
L. Salvage and overhaul

VI. ROLES OF THE SECOND IN TRUCK COMPANY

These are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander. Emphasis on aerial or ladder placement for rescue, secondary egress, and roof operations. Ventilation must be addressed as soon as possible.

REFERENCES: None
PURPOSE: To provide a procedural overview for first and second arriving truck companies

SCOPE: Applies to all Denver Fire Department personnel functioning in an operational capacity at a multi-story attached residential fire

OPERATIONS

All truck company duties are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander.

CONSIDERATIONS

Treat these incidents similar to a single-story residence with the following considerations:

A. Limited access for apparatus and aerial devices
B. Lightweight or Truss Joist I-beam construction
C. Combustible building materials
D. Large common attics
E. Multiple void spaces
F. Large open floor plans
G. Multiple exposures
H. Auto exposure

Assume these structures are light weight construction until confirmed otherwise. The presence of fire within the light weight structural components and voids must be relayed to command.

Fire spread can be rapid. Aggressive void access and roof operations are crucial to prevent fire spread throughout the common voids. Incident Commanders should consider calling for additional resources early.

I. FIRST IN TRUCK COMPANY RESPONSIBILITIES

A. Size up
B. Aerial placement/Ground laddering
   Consider spotting for the roof.
C. Establish Command (if no Chief on scene)
D. Forcible entry for initial attack line placement
E. Search and rescue
F. Utility control
G. Check for extension
H. Salvage and overhaul

II. ROLES OF THE FIRST IN TRUCK

A. Officer
   1. Size up
   2. Officer establishes Incident Command and builds the command structure as the situation dictates and available resources allow.
      a. Brief command statement
      b. First in tactical assignments
         i. Rig placement and assignment for second in truck and other responding apparatus
         ii. Request additional resources and make other assignments as necessary.
      c. When relieved of command, rejoin the Engineer for interior search and rescue or further fire ground operations.

B. Engineer
   1. Rig placement and aerial operation for rescue and/or ventilation
   2. Utility control, if possible
   3. Vent as appropriate.
   4. Rejoin the officer for interior search and rescue or further fire ground operations
   5. Check for extension.
   6. Salvage and overhaul

C. Firefighters
   1. Force entry for primary attack line.
   2. Search for victims and the seat of the fire.
      a. Concentrate efforts on exit passages and bedrooms.
      b. Relay the location of the fire to attack crew.
      c. Report the results of the primary search to command.
d. Begin a secondary search.
e. Report the results of the secondary search.

3. Ventilate as appropriate.
4. Check for fire extension aggressively and early, concentrating on voids and utility chases.
5. Salvage and overhaul.

All members must operate in the rescue mode until all secondary searches are completed.

III. SECOND IN TRUCK COMPANY RESPONSIBILITIES

Priorities are search of the unit above or roof operations.

A. Complete unfinished primary tactical responsibilities.
B. Vent Enter Search (VES)
C. Primary search of the floor above the fire (should be conducted using extreme caution)
D. Roof operations
E. Laddering for rescue, access/egress
F. Force barred windows.
G. Vent for life.
H. Vent for fire.
I. Positive pressure ventilation
J. Check for extension aggressively and early, concentrating on voids and utility chases
K. Check exposures
L. Salvage and overhaul

IV. ROLES OF THE SECOND IN TRUCK COMPANY

These are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander. Emphasis on aerial or ladder placement to the rear for VES, secondary egress, and roof operations.

REFERENCES: None
PURPOSE: To provide a procedural overview for first and second arriving truck companies

SCOPE: Applies to all Denver Fire Department personnel functioning in an operational capacity at a strip mall or single story, single occupancy commercial structure fire

OPERATIONS

All Truck company duties are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander.

CONSIDERATIONS

These fires present unique hazards:

A. Is the building occupied; type of occupancy
B. Location and extent of fire
C. Light weight construction
D. Façade overhangs
E. Roof loads
F. Large open area
G. High capacity utilities

I. FIRST IN TRUCK COMPANY RESPONSIBILITIES

A. Size up
B. Rig placement
C. Establish Command
D. Forcible entry for initial attack line placement
E. Search and rescue
F. Utility control
G. Check for extension
H. Salvage and overhaul
II. ROLES OF THE FIRST IN TRUCK

A. Officer
1. Size up
2. Officer establishes Incident Command and builds the command structure as the situation dictates and available resources allow.
   a. Brief command statement
   b. First in tactical assignments
      i. Rig placement and assignment for second in truck and other responding apparatus
      ii. Request additional resources and make other assignments as necessary.
   c. When relieved of command, rejoin the Engineer for interior search and rescue or further fire ground operations.

B. Engineer
1. Rig placement, spot for the building
2. Check for presence of fire conditions in basement windows.
   a. If fire conditions are present, notify command immediately.
   b. Horizontal ventilation is appropriate.
3. Utility control
4. Vent as appropriate.
5. Report to command on c-side conditions and actions taken.
6. Rejoin the officer for further fire ground operations.
7. Check for extension.
8. Salvage and overhaul

C. Firefighters
1. Force entry for primary attack line.
2. Search for victims and the seat of the fire.
   a. Concentrate efforts on exit passages and bedrooms.
   b. Relay the location of the fire to attack crew.
   c. Report the results of the primary search to command.
   d. Begin a secondary search.
   e. Report the results of the secondary search.
3. Ventilate as appropriate.
4. Check for fire extension.
5. Salvage and overhaul

All members must operate in the rescue mode until all secondary searches are completed.

III. SECOND IN TRUCK COMPANY RESPONSIBILITIES

Priority is dictated by the situation and needs to remain flexible.

A. Complete unfinished primary tactical responsibilities.
B. Vent Enter Search (VES)
C. Primary search of the floor above the fire
D. Roof operations
E. Laddering for rescue, access/egress, and vertical ventilation
F. Force barred windows.
G. Vent for life.
H. Vent for fire.
I. Positive pressure ventilation
J. Check for extension
K. Check exposures
L. Salvage and overhaul

IV. ROLES OF THE SECOND IN TRUCK COMPANY

These are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander and the second in truck officer.

REFERENCES: None
PURPOSE: To provide a procedural overview for first and second arriving truck companies, including the Rescue and Hamer companies

SCOPE: Applies to all Denver Fire Department personnel functioning in an operational capacity at a warehouse fire

CONSIDERATIONS

These fires present unique hazards. Due to large open areas, building construction, machinery, hazardous materials, and large capacity utilities, emphasis must be placed on team integrity and firefighter safety. Conditions on arrival and determining whether the building is occupied or not will determine the strategy and tactics employed:

A. Location and extent of fire
B. Lightweight/special construction
C. Determine the presence and location of fire walls/partition walls.
D. Roof loads
E. Consider early vertical ventilation.
F. Large open floor space
G. High capacity utilities
H. Be aware of the presence of hazardous materials, machinery, and dangerous manufacturing processes. It may be dangerous and create further hazard if the Fire Department shuts these down.
I. Presence of high piled storage
J. Truck companies shall carry taglines and thermal imagers with them on all warehouse calls
K. If significant smoke or fire is present, personnel must deploy with a hose line and/or tagline.
L. Be aware of changing conditions; if smoke is encountered, find the nearest exit, open it, secure it, and deploy a tagline from a fixed point on the outside and continue your search.
M. If the location and extent of fire is not known, consider deploying a tagline parallel to the loading docks. Open the overhead doors as you go. Work from the outside in.
N. Be aware of the distance traveled in the structure relative to air available in your SCBA.
DENVER FIRE DEPARTMENT

STANDARD OPERATING GUIDELINE

Topic No: 2113.05
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Section: OPERATIONS: TRUCK OPERATIONS

Replaces: OPs FOGs 400.01, 401.01, and 402.01 (03-18-04); and 403.01 (01-15-04)

Topic: Truck Company Operations at Warehouse Fires, Including “Big Box Store” Fires

O. Consider additional resources and multiple alarms early.
P. Take the time to deploy rigs appropriately. Consider Level 2 staging from the onset and know your best access before committing resources.
Q. Due to the size of these structures, a primary survey of the entire building may be warranted. Additional hazards/fires may be found.

The use of a thermal imager for interior operations and roof reconnaissance is ideal in these types of structure fires.

I. FIRST IN TRUCK COMPANY RESPONSIBILITIES

A. Size up
B. Rig placement
C. Establish Command, communicate repeatedly the location of command post and side A, and consider Level 2 staging.
D. With the first in engine, form the Interior Team. Maintain the integrity of that team. Coordinate forcible entry with initial attack line.
E. If smoke and/or fire are present, deploy tagline(s).
F. Search and rescue. Hasty search for victims and reconnaissance for fire location and its nearest access. Reconnaissance is critical for deployment of additional companies
G. Utility/machinery control, if appropriate
H. Salvage and overhaul

II. ROLES OF THE FIRST IN TRUCK

A. Officer
   1. Size up
   2. Officer establishes Incident Command and builds the command structure as the situation dictates and available resources allow.
      a. Brief command statement
      b. First in tactical assignments
         i. Rig placement and assignment for second in engine, truck, and other responding apparatus based on reconnaissance information
         ii. Request additional resources and make other assignments as necessary.
c. When relieved of command, rejoin the Engineer for interior search and rescue or further fireground operations.

B. Engineer
1. Rig placement. Should remain with the rig and be mobile in order to reposition based on the Interior Team’s report
2. Prepare aerial for operation
3. Logistical support for the Interior Team
4. Forcible entry for the attack line(s) and/or secondary egress
5. Rejoin the officer for further fireground operations

C. Firefighters
1. Must team up with the first in engine crew to form the interior team. Coordinate forcible entry, locate the fire, and conduct a hasty search.
2. Responsible for deploying taglines for our safety.
3. Utilize thermal imager and other appropriate tactics to locate any victims and fire.
   a. Concentrate efforts on exits, area in front of dock doors, and main aisles. Use taglines and a thermal imager.
   b. Relay the extent and location of the fire to attack crew and command
   c. Locate and open the closest access to the fire.
   d. Locate and open overhead doors, if possible.
   e. Report the results of the hasty search to command.
   f. Report any hazards to command as they are encountered
3. Ventilate as appropriate.
4. Check for fire extension.
5. Salvage and overhaul

All members must operate with caution, keeping in mind air management, the potential for rapid fire spread, and sudden collapse in these types of structures.

III. SECOND IN TRUCK COMPANY RESPONSIBILITIES

Priority is dictated by the situation and needs to remain flexible.
DENVER FIRE DEPARTMENT

STANDARD OPERATING GUIDELINE

Section: OPERATIONS: TRUCK OPERATIONS

Topic: Truck Company Operations at Warehouse Fires, Including “Big Box Store” Fires

A. Level 1 or Level 2 staging unless otherwise directed. Spot apparatus per the Incident Commander. Don’t commit until there is a clear understanding of the situation.

B. Be prepared for:
   1. Forcible entry
   2. Interior operations
   3. Roof operations
   4. Utility management

IV. ROLES OF THE SECOND IN TRUCK COMPANY

These are dictated by the situation and need to remain flexible in order to accomplish the tactical priorities set by the Incident Commander and the second in truck officer.

V. RESCUE AND HAMER COMPANY RESPONSIBILITIES

Priority is dictated by the situation and needs to remain flexible.

A. The Rescue or Hamer companies may not have the same responsibilities as the first or second in truck. They may be required to function as technical resources. These companies do not replace the response of aerial apparatus.

B. Must spot apparatus to allow access for aerials.

C. Rescue may be tasked with extensive forcible entry, RIT operations, ventilation, and/or HazMat functions.

D. Hamer may be tasked with atmospheric and runoff monitoring, identification, and control of on-site hazards, etc.

VI. SUBSEQUENT ARRIVING TRUCK COMPANIES’ RESPONSIBILITIES

A. Apparatus placement as dictated by the Incident Commander

B. Complete unfinished tactical objectives and other assignments as dictated by the Incident Commander.

REFERENCES: None
PURPOSE: To establish the guidelines for DFD personnel responding to incidents involving the investigation of an accumulation of carbon monoxide

SCOPE: Applies to all Denver Fire Department personnel functioning in an operational capacity at a carbon monoxide response

I. CONSIDERATIONS

Carbon monoxide is an odorless, tasteless, colorless gas that is deadly. It is a by-product of a fuel burning process. Many appliances such as furnaces, kitchen stoves, hot water heaters, automobiles, etc. can produce carbon monoxide. When a faulty device or unusual conditions exist, carbon monoxide may be vented into areas where people are present.

Carbon monoxide poisoning may be difficult to diagnose. Its symptoms are similar to the flu, which may include headache, nausea, fatigue, and dizzy spells.

The Occupational Safety and Health Administration (OSHA) has established a maximum safe working level for carbon monoxide at 35 parts per million (PPM) over an eight-hour period, in the general workplace. The U.S. Environmental Protection Agency has established that residential levels are not to exceed 9 PPM over an eight-hour average.

Commercial buildings have many sources of CO not found in residences such as parking garages, drive-through windows, auto repair bays, various “processes”, un-vented gas burners in large confined spaces, forklifts, etc., recognizing the OSHA-established 35 PPM as the acceptable level for commercial buildings. Denver Fire Department has established 35 PPM as the threshold level where all members must use their SCBA.

All Truck Companies will be equipped with Multi-Rae meters with CO detection capability. To provide better coverage for the outlying sections of the city, several select Engine companies will be equipped with Multi-Rae meters with CO detection. All companies will be equipped with Single-Gas CO meters.

Company officers are responsible for ensuring that their meters are operating correctly. All meters, except for the single gas CO meters, are to be checked and calibrated monthly for proper operation by Station 6. Your meter should be sent in on the corresponding day of the month. For example: Truck 2 would send their meter in on the second day of that month.
II. TRUCK/METER EQUIPPED ENGINE COMPANY RESPONSIBILITIES

The Officer establishes incident command and builds the command structure as the situation dictates and available resources allow. Two firefighters with SCBA enter the structure with a multi gas meter. The meter should be zeroed and set up inside a clean air environment (no vehicle fumes). Any additional resources needed should be relayed to the incident commander immediately.

NOTE: AN ALARMING DETECTOR IS ASSUMED TO BE CORRECT UNTIL DETERMINED OTHERWISE.

A. Be sure the structure is evacuated and start the investigation procedure with 2 – 3 firefighters only.

An initial air reading should be taken just inside the entry point to ascertain initial conditions, keeping in mind that meters take a short period of time to analyze the air sampled.

B. Determine if anyone exhibits any symptoms of carbon monoxide poisoning (symptoms may include, but are not limited to, headache, nausea, fatigue, dizzy spells, or impaired judgment).

If anyone is presenting with signs and symptoms of carbon monoxide poisoning, command shall request Hamer 1 and an ambulance Code 10. If Hamer 1 is not available, another truck company with meters shall be dispatched to verify the initial meter readings.

C. If no one exhibits any symptoms of carbon monoxide poisoning, check the interior to get a CO reading in PPM.

1. Keep windows and doors closed until house is checked completely using the carbon monoxide meter.
2. Turn on any appliances that can create carbon monoxide and make sure levels don’t increase while running (furnace, hot water heater).
3. Ventilation (electric fans) of the structure shall begin to bring levels below 9 PPM unless it is a commercial structure, then 35 PPM is acceptable.
4. Xcel Energy shall be notified if necessary (malfunctioning furnace, etc.)
5. If Xcel has been notified, they should be enroute and the crew should stand-by until the arrival of Xcel.

6. Inform the residents of findings and actions taken.

7. If CO levels are below threshold limits of 9 PPM (residential) or 35 PPM (commercial), then inform the resident to have their CO detector checked as recommended by the manufacturer.

8. Advise the residents to call 911 if the alarm reactivates.

III. SINGLE GAS CO DETECTORS

1. A single gas CO meter will be issued and shall be permanently attached to the in-service medical or oxygen bag on all companies.

2. Once meter is turned on, leave it as is. The default mode when turned on will measure the low limit of CO (35 PPM) and will go into alarm at or above this level.

3. The meter is designed to run in a continuous manner; therefore, once placed in service there is no need to shut the meter off.

4. These meters are to operate as a safety buffer only, to alert fire crews of inadvertently operating in a CO contaminated atmosphere. (i.e. medical calls, etc.)

5. If the meter goes into alarm (35 PPM), the rescuers and victims shall retreat to a safe area and the company officer shall contact Fire Dispatch to initiate the appropriate CO response which will include a Truck Company/and or Hamer 1.

6. If the meter goes into alarm, there is no need to send in for calibration.

7. Calibration is required every six months. Companies will not be assigned a specific meter; Station 6 will maintain a calibrated and working inventory of meters that will be distributed out when the districts send in their current meters. Company officers and members will be responsible for the inventory of the meter that they receive. The single gas meters shall be sent to Station 6 for calibration as follows:

   - January/July: District 2
   - April/October: District 5
   - February/August: District 3
   - May/November: District 6
   - March/September: District 4
   - June/December: District 7
I. Subject, Purpose, and Scope

SUBJECT: Operations/Tactical Appendix in high rise and standpipe equipped buildings.

PURPOSE: To define a Strategic approach and supported Tactical Appendix for the size-up and mitigation of fires in high rise or multi-storied standpipe equipped buildings.

SCOPE: This guideline shall apply to all department members involved in emergency operations in high rise or multi-storied standpipe equipped buildings.

II. Introduction

The Denver Fire Department has created a guideline to outline procedures and operations at fires in high rise buildings. The Incident Command System is a key feature of the National Incident Management System (NIMS). The management system is designed to enable effective and efficient incident management by integrating a combination of personnel, procedures and equipment operating within a common organizational structure, designed to effectively mitigate high rise incidents. While other Department standard operating guidelines also apply to an incident of this type, operations at these fires have so many unique requirements and dangers, that a guideline specifically covering this type of incident is needed. As with all other Department guidelines, this document is not designed as, nor should it be used as a step-by-step manual at the scene of an emergency. Instead, it should be viewed as a guide that establishes a framework for how a high-rise incident should be handled by the Denver Fire Department. It is designed to achieve the mission of life safety, incident stabilization and property conservation at the scene of an emergency. Deviation from this guideline must be performed with the acknowledgement of the Incident Commander.

Due to the dynamic challenges faced during any fire ground operation, Officer Discretion is paramount in achieving the desired result of safe incident mitigation. The use of Officer Discretion for deviation of this guideline with justification shall be communicated to all on scene companies including the Incident Commander.

III. This guideline addresses the following tactical considerations:
**Subject, Purpose, and Scope/Introduction**

A. Obtaining access to the fire building, securing keys, gaining control of elevators and other building systems.

B. Establishing Lobby Control to assist with personnel accountability.

C. Establishing a Building Systems Group to control the building’s fire protection systems.

D. Securing a water supply and supplying building systems with water, or working around the building systems.

E. Locating the fire floor using detection systems and witness reports or other means.

F. Initiating a fire attack and determining scope of the fire and the need for additional hose lines.

G. Conducting primary search of the fire floor.

H. Determining the need for evacuation of areas not involved in the initial fire.

I. Evacuating all or part of the fire building. Evaluating the decision to protect building occupants in place.

J. Conducting reconnaissance on the floor above for the need to provide additional hose lines or rescue resources.

K. Conducting reconnaissance on all floors above the fire floor for fire spread, smoke infiltration, and rescue needs.

L. Determining the proper ventilation practices using building systems or fire department resources.

M. Level II-Exterior Staging

N. Interior Staging.

O. Rehabilitation operations.
The Denver Fire Department utilizes the National Incident Management System (NIMS). The command and control functions within a high rise incident will fall under the communicative direction of NIMS.

Due to the dynamic and unique challenges that high-rise occupancies present during fire suppression activities, the Incident Commander needs to be proactive in realizing that his/her manageable span of control (5) may quickly be exceeded upon confirmation of a working structure fire and utilize the modular framework within NIMS to build the Command and Control components as needed.

ICS Supervisory Position Titles:

<table>
<thead>
<tr>
<th>Organizational Level</th>
<th>Title</th>
<th>Support Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Command</td>
<td>Incident Commander</td>
<td>Deputy</td>
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<tr>
<td>Command Staff</td>
<td>Officer</td>
<td>Assistant</td>
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<tr>
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<td>Unit</td>
<td>Leader</td>
<td>Manager</td>
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</tbody>
</table>

Within the National Incident Management System (NIMS) resource allocation will begin with the assignment of Single Resources.

I. **Single Resource:** An individual, a piece of equipment and its personnel compliment, or a crew or a team of individuals with an indentified work supervisor.

Please refer to the Tactical Appendix-Command and Control (Topic 2114.21) in regards to Single Resource utilization as defined by the DFD.

Once the incident has progressed to multiple resources and or companies being assigned to specific geographical areas or functional tasks, the implementation of Division/Groups should be considered.

II. **Division and Groups:** (Supervisor) Division and/or Groups are established when the number of resources exceeds the manageable span of control (5) of Incident Command.
Divisions are established to divide an incident into physical or geographical areas of operation. Groups are established to divide the Incident into functional areas of operation. Please refer to the Tactical Appendix-Command and Control (Topic 2114.21) in regards to Division/Group utilization as defined by the DFD.

As the incident develops beyond the utilization of Divisions/Groups to manage the recommended span of control (5) and/or the Incident Commander identifies the need to expand the command and control organization, the NIMS system recommends the implementation of Branch Level assignments.

III. **Branches:** (Directors) Branches may serve several purposes and may be functional, geographic, or both, depending on the circumstances of the incident. In general, Branches are established when the number of Divisions or Groups exceeds the recommended span of control (5).

Please refer to the Tactical Appendix-Command and Control (2114.21) in regards to the Branch Level recommendations as defined by the DFD.

If the incident expands beyond the Branch Level organizational capacity, the Incident Commander will need to incorporate General Staff assignments.

IV. **General Staff:** The General Staff is comprised of the Operations, Planning, Logistics and Finance Section Chiefs. In addition to the Command function, the General Staff represents the other four management functions within the Incident Command system. The General Staff reports directly to the Incident Commander.

V. **Command Staff:** The Command Staff report directly to the Incident Commander and provides critical support to both the I.C. and others on the Command Team. These positions can include the Safety Officer, PIO, Liaison Officer and Intelligence Officer. These positions are not considered to be a part of the Incident Commanders span of control.

Within the Command and Control organization the Incident Commander will need to consider both Level II and Interior Staging

**Staging: Level II(Exterior Staging)/ Interior Staging:**

The Level II (Exterior Staging) will be located at a predetermined exterior location as identified by the Incident Commander and its Manager will report directly to the I.C.
The Interior Staging will be located two floors below the fire floor and its Manager will report directly to the Incident Commander.

Staging is not considered part of the Incident Commanders span of control.
The Incident Commander is responsible for the safe management of all personnel at emergency scenes.

A Safety Officer shall operate at every working high-rise incident. The Safety Officer reports directly to the Incident Commander. Until a Safety Officer is assigned, the IC is the Safety Officer. While the Safety of on scene personnel is the ultimate responsibility of the Incident Commander, the designation of a Safety Officer enables the Incident Commander to identify a specific individual who will assist with ensuring the safety of on-scene personnel. This allows the Incident Commander to focus on the overall scene management. The primary criteria for selecting a Safety Officer should be based on the individual’s technical knowledge of the particular procedures being utilized at the emergency scene. Specific procedural familiarity is essential to the Safety Officer, enabling him or her to accurately evaluate the activities of the personnel engaged in emergency scene operations. Safety Officers shall monitor and assess on-scene hazards and unsafe situations to ensure the highest degree of personnel safety.

Please refer to Attachment B: Standard Operating Guidline-2110.05-Safety Officer Roles and Responsibilities for additional information.
Hose line selection of the first arriving Engine Company Officer will dramatically affect the Command and Control system employed by the Incident Commander. It is imperative that the first arriving Engine Company Officer make an informed decision on this selection. At a minimum, the following should be considered in this selection:

- Pre-plan Information
- Known occupancy/life hazards
- Information from the calling party
- On scene size-up

The Denver Fire Department is committed to the “team concept” in regards to hose line deployment. Due to this commitment, it is imperative that the first two Engines (second two, etc.) on scene have the same size hose line, and prior to any back-up or exposure protection deployment, these Engine Companies work together ensuring the primary attack line is in place and operating.

The following is the approved Hose lines selection for the Denver Fire Department for Fire Alarm investigations and reported Fires in High Rise Occupancies.

**Fire Alarm Investigations including Private Fire Alarms, DFD Box Alarms and Alarm Bells Ringing:**

- Hose line selection will be at the discretion of the Engine Company Officer. 200 feet (four approved high rise packs) of either 2” or 2 ½” hose.

**Report of Fire in a High Rise Structure:**

- *The first arriving Engine Company Officer shall state the initial hose line selection on the assigned Tactical Channel upon arrival.*

- The initial attack line selection will be at the discretion of the first arriving Engine Company Officer. 200 feet (four approved high rise packs) of either 2” or 2 ½” hose will be approved for deployment.

- The second arriving Engine Company will be required to carry the same size hose line (200’) as the first arriving Engine Company unless an extenuating circumstance dictates deviation from this guideline. If the second arriving Engine Company chooses a different hose line, this choice shall be communicated on the assigned Tactical Channel ensuring the IC is aware.
All subsequent arriving Engine Companies will be required to carry 200 feet (four approved high rise packs) of 2” or 2 ½” hose upon assignment into the fire building by the Incident Commander. The team concept will be utilized with all assigned Engine Companies and therefore communication between them will be paramount in ensuring that the same hose line selection is consistent.
The Denver Fire Department is committed to the safe and effective mitigation of structure fires relating to High-Rise Occupancies. Therefore, the following Strategic Priorities must be considered in order to achieve safe and effective incident mitigation by the Incident Commander upon arrival of the first alarm resources:

I. Incident Command
II. Systems/Lobby Control
III. Exterior Rescue
IV. Interior Staging
V. Rapid Intervention Team
VI. Primary Fire Attack
VII. Back up (Fire Floor)/ Exposure (Floor Above) Fire Attack
VIII. Search/Rescue/Ventilation/Forcible Entry of the Fire Floor
IX. Reconnaissance/ Search/Rescue/Ventilation/Forcible Entry of the Floor Above the Fire Floor
X. Reconnaissance/Protect in Place/Evacuation of the floors above the floor above the fire floor with an immediate LCAN report to the IC of the top floor of the fire building.

Please reference the Tactical Appendix- 1st Alarm Resource Allocation (Topic 2114.22) for the Tactical Priorities and recommended assignments of the 1st alarm resources.
I. First Alarm Resources

- Four Engines
- Two Trucks
- One Rapid Intervention Team
- Rescue 1
- HAMER 1
- Three District Chiefs

II. Second and all subsequent Alarm Resources

- Four Engines
- Two Trucks
- 1 District Chief
- Command Staff/Support Personnel
Based on the needs of the Incident, the Incident Commander will need to consider the establishment of two Staging Areas.

**Level II (Exterior Staging):** All additional resources requested by the Incident Commander shall respond to the Level II Staging area (unless an assignment has been given by command) and report to the Staging Manager (if assigned) or to the Incident Commander for assignment. The Company Officer of the first arriving apparatus will be initially assigned the duties of Staging Manager. A separate radio channel should be utilized to communicate directly with dispatch to request additional resources and communicate with Interior Staging to deploy resources to interior staging area. **No member shall enter the fire building unless assigned, and shall have full PPE.**

**Interior Staging Officer:** This will be located two floors below the fire floor. The Interior Staging Officer will be the first Company Officer directed by the Incident Commander to report to the Interior Staging area.

Staging Managers will communicate directly to the Incident Commander and are not considered to be part of the overall span of control.
The use of elevators within a high-rise structure fire is a valuable logistical tool to reduce reflex time and firefighter fatigue.

Although elevators can be a very valuable logistical tool, they can also quickly become dangerous and deadly traps. Extreme caution should always be exercised with regard to the use of all elevators.

The following procedures and considerations must be strictly adhered to and enforced by the Incident Commander during fire ground operations including the investigation of Class I Private Fire Alarms, DFD Box Alarms and Alarm Bells Ringing.

I. If there is Heavy fire upon arrival and the potential of any of the Building systems being compromised, use the stairs

II. If the alarm panel or size up information indicates there is smoke or fire in the elevator machine room or hoist way, use the stairs

Beware of Elevator Shunt Trip Systems-Please reference Attachment A: Standard Operating Guideline 2111.17 Elevator Operations for definition, clarification and training purposes

III. If the building is equipped with multiple elevator banks utilize a bank that does not service the fire floor

IV. Do not use an elevator that is not equipped with Phase I or II “Fire Service Recall and Control” during the pre-control phase of fire ground operations

V. All personnel shall be equipped with Full PPE, SCBA, the necessary tools and equipment, and a Radio when utilizing an elevator

VI. Don’t overload the elevator

VII. Designate an Elevator Operator

VIII. Visually inspect the Hoist-way for Water, Smoke, and Fire

IX. Never take an elevator below grade

X. Never take an elevator directly to a reported fire floor or floor of alarm
XI. Stop two (2) floors below the reported fire floor or floor of alarm

These procedures are designed to maximize firefighter safety when utilizing elevators for operations in multi-story and high-rise buildings. These procedures must be strictly adhered to during the Pre-Control Phase of the fire ground or emergency operation. However, keep in mind that once the incident has been brought under control, the Incident Commander or his designee may initiate a more liberal utilization of elevators as a logistical tool, if it is determined safe to do so, if the elevator(s) are operating properly, and if it would positively contribute to the efficiency and effectiveness of the overall fire ground or emergency operation.

Please reference Attachment A: Standard Operating Guideline 2111.17 Elevator Operations for further explanation and training in regards to the safe utilization of Elevators during fire ground operations.
ATRIUM – a continuous opening through two or more floors other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment shafts, which is closed at the top.

ANNUNCIATOR PANEL – a graphic display of a building or area of a building that indicates the source of an alarm, or the operation of a fire protection system. This panel may be located at the front entrance, in the Fire Command Center, on each floor, or in each area. Areas of a building that house specific processes or systems, such as a computer room with a special extinguishing system may also have its own annunciator panel. These systems must be connected to the main fire alarm panel.

AUTO EXPOSURE – fire spread up the outside of a building, floor-to-floor, by way of the windows or exterior curtain walls. This type of fire spread is common at high-rise fires and places all areas of the building above the fire area in jeopardy.

BRANCHES- (Directors) NIMS Terminology- Branches may serve several purposes and may be functional, geographic, or both, depending on the circumstances of the incident. In general, Branches are established when the number of Divisions or Groups exceeds the recommended span of control (5).

BUILDING COMMUNICATIONS SYSTEMS – these systems allow Fire Department personnel to transmit information from the Fire Command Center to all or part of the building. They also allow the Command Center to receive information from certain areas within the structure. (See Topic 2114.26 for further information)

CENTER CORE CONSTRUCTION – a type of construction in which the elevators, stairways, and building support systems are grouped together in the center of the building. The core is usually constructed of concrete and steel or a combination of both, and is fire rated. The floors of the building are usually constructed of concrete poured over metal decking and are supported by protected structural steel or a truss assembly. An exterior wall constructed of glass or stone is fastened to the structural steel frame or truss system supporting the floors. The exterior wall is a curtain wall which leaves a gap between the structural frame and the exterior wall, creating an avenue for fire spread unless quality fire-stopping is installed per code requirements.
COMMAND STAFF- NIMS Terminology-The Command Staff report directly to the Incident Commander and provides critical support to both the I.C. and others on the Command Team. These positions can include the Safety Officer, PIO, Liaison Officer and Intelligence Officer. These positions are not considered to be a part of the Incident Commanders span of control.

DAMPER – a device used to control the airflow in the ducts of a building’s heating, ventilation, and air conditioning (HVAC) system.

DIVISION AND GROUPS-(Supervisor) NIMS Terminology- Division and/or Groups are established when the number of resources exceeds the manageable span of control (5) of Incident Command. Divisions are established to divide an incident into physical or geographical areas of operation. Groups are established to divide the Incident into functional areas of operation.

ELEVATOR MACHINE ROOM – a mechanical room or area housing the equipment which operates the elevators. A building that has multiple banks of elevators may have more than one elevator machine room. These rooms are usually found at the top of the elevator shaft when the elevator is of the electric traction type. Some types of elevators, such as hydraulically operated systems, may have a control room at the bottom of the hoist way. Some elevator systems utilize a “machine-room-less” (MRL) elevator control system in which there is no machine room, just a control panel, which may be located on virtually any floor of the building top to bottom. In this type of installation, all of the elevator machine components are located within the hoist way itself. (See Attachment A for further information)

ELEVATOR RECALL – a system installed on an elevator that provides for return of the elevator cars to the designated level of a building in an emergency. The recall may be accomplished automatically when the building goes into alarm, or may only be activated when a switch is operated. Phase I service type for elevator recall only returns the elevator(s) to the designated level and leaves the cars there with the doors open, while Phase II service provides for both recall and subsequent controlled use of firefighters by means of a special key. Most recent high-rise buildings in Denver are fitted with Phase II or “Firefighter’s” service. (See Attachment A for further information)

EMERGENCY POWER SYSTEM – a backup electrical system, generator, batteries, or other acceptable electrical supply that is used when the normal
electrical system in a building fails. Diesel-fueled systems should have an on-site fuel supply of eight hours, and should be capable of operating fire alarms, detection systems, exits, emergency lighting, fire pumps, smoke control equipment, emergency ventilation systems, communication systems, emergency elevator operations (high rise buildings only), and processes where interruptions would pose a serious hazard. The controls and/or gauges for this installation may be located in the Fire Command Center.

**FIRE COMMAND CENTER** – the room or area in a high-rise building designed for control of fire operations. This room or area may contain an annunciator panel, fire alarm panel, emergency communications devices, elevator status, elevator control devices, emergency or backup power supply controls, building plans, equipment, keys and handsets to be used by firefighters.

**FIRE DAMPER** – a damper used to restrict the passage of heat, fire, and smoke in the building’s HVAC systems.

**FIRE DEPARTMENT CONNECTION (FDC)** the Fire Department connection on the outside of a building that allows Fire Department engines to supply water to sprinkler and standpipe systems in the building. There may be multiple FDC’s present depending upon the design and height of the building.

**FIREFIGHTER AREA OF REFUGE** – refers to a tactic used to provide firefighters with an area of refuge during fire attack to protect against wind driven fires. In multiple dwellings, apartment doors on either side of the fire apartment can be opened and maintained on the same side of the building as the fire apartment. If a violent wind event occurs, such as loss of the windows on the windward side of the building, those apartments can be used for areas of refuge by firefighters. Apartments across the hall from the fire apartment should be avoided as refuge areas because the wind may trap firefighters in the air flow path from windward to leeward sides of the building.

**FIREFIGHTER HANDSET** – a portable telephone supplied by the building that is taken with firefighters when operating in a high-rise building. This handset is plugged into remote jack locations throughout the building, and communications are established with the Fire Command Center.

**FIRE TOWER (or SMOKE TOWER)** – an enclosed stairway connected to each floor by an outside balcony or fire-resistive vestibule that is vented to the outside. This arrangement is designed to provide for smoke-free exiting from the
FLOOR AREA SEPARATION – two types are generally present; open floor space, where the entire floor is one large open area, or compartmentalization, where the floor is divided into fire-rated separations. The open floor concept is commonly found in commercial office buildings, while compartmentalization is more common in residential occupancies.

GENERAL STAFF- NIMS Terminology-The General Staff is comprised of the Operations, Planning, Logistics and Finance Section Chiefs. In addition to the Command function, the General Staff represents the other four management functions within the Incident Command system. The General Staff reports directly to the Incident Commander.

GROUPS AND DIVISIONS-(Supervisor) NIMS Terminology-Division and/or Groups are established when the number of resources exceeds the manageable span of control (5) of Incident Command. Divisions are established to divide an incident into physical or geographical areas of operation. Groups are established to divide the Incident into functional areas of operation.

HIGH-RISE BUILDING – a building defined by the Denver Building Code having any portion of a floor used for human occupancy that is more than 75 feet above the lowest level of Fire Department vehicle access.

HVAC – the Heating, Ventilation, and Air Conditioning system. This system may also be used by the Fire Department to control fire and smoke movement during an emergency. Many systems are designed with automatic and manual fire controls for this purpose; these controls are located in the Fire Command Center.

KNOX BOX – a locked box at a building that contains keys for entrance into the building and its interior spaces and/or elevator keys. All KNOX boxes in Denver are keyed alike, so that any fire company can gain access to each building with a KNOX box. Other jurisdictions that the DFD serves, such as the City of Glendale, have a different KNOX box key which has been provided to all fire companies in the city. These boxes are typically located at the main entrance to the building. Smaller “Lock Boxes” that are opened with a Fire Department barrel key are also present in some occupancies.
LEVEL II STAGING (Exterior) – Level II Staging is an external staging area designated by the Incident Commander that is used to gather equipment and personnel for use at a high rise fire. Level II Staging operates directly under the Incident Commander. Ideally, the location is easily accessible for both incoming companies and companies being deployed into the fire area. Staging should be located far enough away to provide for the safety of members and equipment, but close enough to allow rapid deployment of resources.

LOBBY – the main entrance and ground floor area of a building, usually containing elevator(s), stairway access, and the Fire Command Center.

MANUAL PULL STATION – a manually-operated fire alarm device located at various locations in a building. In many buildings, a phone jack for the firefighter’s handset is located near each manual pull station.

NEUTRAL PRESSURE PLANE (NPP)– The level within a building at which the barometric pressure both inside the building and outside the building are the same. There is no active normal movement of air inside the building either up or down in the zone containing the NPP. It is dynamic and may affect more than one floor of the building at any given time and it may also change as environmental factors adjust. Firefighters can’t control the location of the NPP. It is mutually dependent and operates synergistically with Stack Effect.

POKE-THROUGH CONSTRUCTION – a type of construction that allows utilities and other objects to pass through fire-rated walls and floors. If not properly sealed after construction, this practice allows fire and smoke to move from one compartment within a building to another.

REFUGE AREA (AREA OF RESCUE ASSISTANCE) – an area in a building designed to protect persons in that area from fire and smoke. This may be accomplished by constructing fire-rated barriers, such as walls and doors, around the refuge area, or by means of ventilation, which pressurizes the refuge area and theoretically keeps out the fire and smoke. Usually these areas are located on each floor of a high-rise building, near the elevators or stairways.

REHABILITATION–Due to the extreme physical efforts required in fighting a fire in a high-rise building, the issue of rehabilitation must be considered. Even after completing an assigned task, fire companies may be required to walk down many flights of stairs to reach areas of rehabilitation. The condition of firefighters must be monitored for safety.
INTERIOR REHABILITATION (RE-HAB) - should be established on lower floors whenever an incident may be of a long duration and the fire is on the upper floors, or when other conditions warrant. This area should be established in a safe area of the building, preferably one or two floors below the Interior Staging Area. The area should contain liquids, food, medical personnel, medical supplies, and communication equipment. Provisions for the transport of immobile personnel should also be considered.

EXTERIOR REHABILITATION - should be established for protection from the elements, the media, and other distractions, as well as the safety of personnel. Buildings near the fire building may be suitable for this purpose. This area should also contain refreshments, medical care, and restrooms.

The Incident Commander may choose to assign an Officer in charge of “RE-HAB.” Assistance from outside agencies such as the Red Cross or Salvation Army may be coordinated under this position.

SECTIONAL CONTROL VALVES – manual valves on a sprinkler or standpipe system that control the flow of water to a specific section or floor of the building. These valves are used to control sprinkler or standpipe operations in a specific area without affecting the rest of the system.

SHUNT TRIP – a power control system involving building elevator systems that automatically shuts power down to an elevator when a heat detector activates in an elevator hoist way or elevator machine room. Shunt trip systems are present when elevator machine rooms and hoist ways are sprinklered. Shunt trips are designed to make sure that electrical equipment is de-energized prior to the application of water, so that erratic and unpredictable elevator behavior can be thwarted. They are activated by heat detectors in machine rooms and hoist ways.

SINGLE RESOURCE – NIMS Terminology – Is an individual, a piece of equipment and its personnel compliment, or a crew or a team of individuals with an indentified work supervisor.

SMOKE CONTROL SYSTEM – an engineered system that uses mechanical fans to produce pressure differences to control smoke movement across smoke
zones. The system is designed to exhaust smoke from the zone in alarm to the exterior of the building and to prevent smoke infiltration to the surrounding zones by pressurization.

**SPRINKLER SYSTEM** – a fire extinguishing system that consists of a network of pipes and sprinkler heads designed to provide water in selected areas of the building. On each floor, the sprinkler heads are usually mounted overhead and spaced to cover approximately 100 square feet. The water supply for the sprinkler system is usually inter-connected to the standpipe system, and fire department engines can also supply water to these systems by way of the fire department connection.

**STACK EFFECT** – the vertical, natural air movement throughout a high-rise building caused by the difference in temperatures between the inside air and the outside air. Positive stack effect is characterized by a strong draft from the ground floor to the roof and is more significant in colder climates. Negative stack effect causes air to move from upper floors toward the ground floor and occurs in hot climates. Negative stack effect is usually not as dramatic because the difference in temperature is not as great. See Neutral Pressure Plane for a closely related concept.

**STAGING** – (Interior) - At high-rise incidents, an interior staging area is established two floors below the fire floor and reports directly to the Incident Commander. The interior staging area is used to collect and distribute equipment and personnel for the firefighting effort.

**STAIRWAY (EQUIPMENT) SUPPORT UNIT** – a group of firefighters used to transport equipment from the lobby level to the interior staging area by way of the stairwells. This method of equipment transport may be utilized when it is not feasible to use elevators or when deemed appropriate by the IC. The early establishment of an SSU is recommended for serious fires to maintain an adequate supply of tools, equipment, and air cylinders at staging.

**STANDPIPE** – a water supply system installed in a building and used by the Fire Department to provide water for hose lines. Outlets are located either in the stairwell or on each floor within 10 feet of a stairwell door. Multiple outlet locations are required whenever 100 feet (200 feet in fully-sprinklered buildings) of travel from the standpipe to an area is exceeded. The system is supplied by city water mains and a fire pump that will theoretically supply enough volume and pressure to maintain the required flow pressure at the top-most outlet with 500-
Standpipe systems are required in every building four or more stories above grade. Per International Fire Code (IFC), definitions are:

- Class I is a standpipe system equipped with 2-1/2 inch outlets.
- Class II is a standpipe system directly connected to a water supply and equipped with 1-1/2 inch outlets and hose.
- Class III is a standpipe system directly connected to a water supply and equipped with 1-1/2 inch outlets and 2-1/2 inch outlets.

Valve outlets may have Pressure-Reducing Valves (PRVs) or other pressure-restricting devices installed, which could significantly affect the pressure and flow obtained from the standpipe system.

**STRATIFICATION** – when air or smoke is heated it tends to rise. This rising will continue until the air or smoke cools off, at which point it will tend to accumulate and spread out horizontally. When this occurs inside a high-rise building, the smoke will start to accumulate on floors above the fire, creating additional hazards to persons in those areas. Even though the smoke is cold, it is still very deadly. The Upper Floors Branch Director or any Company that is assigned to the area above the floor above the Fire Floor should aggressively focus on the ventilation and removal of stratified smoke.

**WIND DRIVEN FIRE** – a phenomenon that occurs when winds complicate firefighting efforts. Most notably it happens when windows fail on the windward side of the building resulting in the forceful pushing of heat, fire and smoke back into the building. Common flow paths include hallways and stairwells which firefighters are utilizing for fire attack. This can create dangerous conditions for members operating in these areas. At times a flanking attack from adjoining units may need to be considered if wind conditions prevent attack or advancement at the apartment door. Firefighters should anticipate wind conditions especially on the upper floors of high rise buildings and be ready to adjust tactics to counter these effects.
The Denver Fire Department will utilize the NIMS Command Structure for all reported high rise structure fires. The National Incident Management System is very dynamic and fluid which allows Incident Commanders the ability to build a Command Structure that can address any Incident. Due to the dynamic and fluid nature of this system, it is important to identify the specific functions, terminology and assignments within the framework that the Denver Fire Department will utilize during a high rise fire incident.

The following Command and Control areas will be utilized when needed during a high rise structure fire event:

**ICS Supervisory Position Titles:**

<table>
<thead>
<tr>
<th>Organizational Level</th>
<th>Title</th>
<th>Support Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Command</td>
<td>Incident Commander</td>
<td>Deputy</td>
</tr>
<tr>
<td>Command Staff</td>
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<td>Assistant</td>
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<td>Chief</td>
<td>Deputy</td>
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<tr>
<td>Unit</td>
<td>Leader</td>
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<tr>
<td>Single Resource</td>
<td>Leader</td>
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Within the National Incident Management System (NIMS) resource allocation will begin with the assignment of Single Resources.

**I. Single Resource:** An individual, a piece of equipment and its personnel compliment, or a crew or a team of individuals with an indentified work supervisor.

The Denver Fire Department will define the utilization of a Single Resource as either a crew (Engine 1, Tower 1 etc.) or team. The team concept will be utilized when 2 or more crews are teamed together. This will commonly happen when two Engine Companies are married together to deploy a fire attack line. For example; if Engine 1 and Engine 2 have been assigned the task of deploying an attack line, the IC, Branch Director or Division Supervisor will assign this task and identify a work supervisor. For this example the supervisor will be the Officer from Engine 01 and the balance of Engine 1’s crew along with Engine 2 will be the team. This work supervisor’s radio ID will be “Engine 01.”
Once the incident has progressed to multiple resources and or companies being assigned to specific geographical areas or functional tasks, the implementation of Division/Groups should be considered.

II. Division and Groups: (Supervisor) Division and/or Groups are established when the number of resources exceeds the manageable span of control (5) of Incident Command. Divisions are established to divide an incident into physical or geographical areas of operation. Groups are established to divide the Incident into functional areas of operation.

The Denver Fire Department will utilize Divisions within a high-rise structure as a defined geographical area. This will mean that each floor within a high-rise will be referred to as a Division. For example; upon arrival to a reported fire within a high-rise and the fire floor has not been confirmed, the IC may assign the first responding resources to report to the fire floor. This can then be defined as the Fire Floor Division with an identified Division Supervisor. Upon arrival and confirmation of the fire floor the Division Supervisor will radio to Command the specific fire floor. The IC will have the discretion to rename this Division to the actual floor (Division 21 for example) or leave it as the Fire Floor Division. The remaining Division designations will be the actual floor number (the floor below will be Division 20 and the floor above will be Division 22).

The Denver Fire Department will utilize Group designations to identify specific functional assignments with an assigned Group Supervisor. For example, the IC may assign a Company(s) to the specific task of Evacuation. This will be referred to as the Evacuation Group and could necessitate the need for this Group to move to various areas within the fire building to accomplish this task.

As the incident develops beyond the utilization of Divisions/Groups to manage the recommended span of control (5) and/or the Incident Commander identifies the need to expand the command and control organization, the NIMS system recommends the implementation of Branch Level assignments.

III. Branches: (Directors) Branches may serve several purposes and may be functional, geographic, or both, depending on the circumstances of the incident. In general, Branches are established when the number of Divisions or Groups exceeds the recommended span of control (5).

The Denver Fire Department will define Branch Level assignments within a high rise structure fire as follows:
Suppression Branch: (Director) This Branch includes the fire floor, the floor above, and the floor below. These three floors can be divided into Divisions (Supervisor) based on the needs of the incident.

Example: If the fire floor is on the 16th floor the “Suppression Branch” is responsible for the 15th, 16th, and 17th floors. The direction of suppression of the fire can be divided into Division designations such as Fire Floor Division, Division 15, Division 16 and Division 17 etc.

Upper Floors Branch: (Director) This Branch includes all floors above the floor above the fire.

Example: If the fire floor is on the 16th floor, the “Upper Floors Branch” is responsible for the 18th floor to the roof and all activities required within this area. The direction of the Upper Floors Branch can be divided into Group designations, such as Recon Group, Search and Evacuation Group, Ventilation Group etc. This area can also be separated into Divisions if the IC or Branch Director so chooses. This would include Division 18, and Division of all floors to the top floor and the Roof Division.

Lower Floors Branch: (Director) This Branch includes all floors below the floor below the fire.

Example: If fire floor is on the 16th floor, the “Lower Floors Branch” is responsible for the 14th floor downward including the 1st floor, basement and or sub basements. The direction of the “Lower Floors Branch” can also be divided into Groups or Divisions. Group designations may include Lobby Control, Building Systems, Stairwell Support, Medical Group etc. If the IC or Branch Director so chooses, the floors within the Lower Floor Branch can be separated into Divisions which could include the division of all floors two floors below the fire floor downward.

The Lower Floors Branch Director will responsible for ensuring that the following areas are assigned when needed:

1. **Lobby Control** whose responsibility is to track the accountability of all companies and personnel that enter the building (See Tactical Appendix: Lobby Control/Accountability, Topic 2114.25).
2. **Building Systems** to direct the building’s fire protection, response and communication systems and ensure proper air movement within the structure. The Building Systems position also includes the responsibility to communicate with the occupants in the building; directing the occupants to either shelter in place or to
evacuate utilizing the appropriate stairwell (See Tactical Appendix: Fire Protection and Building Systems, Topic 2114.27)

3. **Elevator Operations** are the responsibility of the Lower Floors Branch Director. The Elevator Operator is normally the Engineer from the 1st due Truck (See Attachment A: Elevator Operations, SOG 2111.17).

4. **Equipment Support** which will be established when needed to shuttle tools, equipment and air cylinders to the staging area located two floors below the fire floor (See Tactical Appendix: Equipment Support Operations, Topic 2114.28).

5. **Rehab** to refresh firefighters, providing adequate fluid and food replacement

**Exterior Branch:** (Director) This position is responsible for all exterior areas surrounding the fire building. The following positions should be considered and established when necessary:

1. **Water Supply** which may be supervised by the Engineer from the third due Engine Company.
2. **Exterior Rehab Unit** which is staffed in cooperation with EMS and established by the Exterior Branch Director.
3. **Police Operations, Support Agencies (non-fire dept.) and Helicopter Operations** may also be the responsibility of the Exterior Branch Director.

**Medical Branch:** (Director)-Upon report of a Structure Fire, Denver Health will dispatch an Ambulance and a Supervisor. The Incident Commander should consider the establishment of the Medical Branch to address the medical needs of the incident and allow this Branch Director the authority to utilize a separate radio channel and the ordering of additional resources.
I. Initial Response to a Reported High Rise Fire:

- Four Engines
- Two Trucks
- One RIT – Truck Co. (Engine Co. may be assigned)
- Rescue 1
- HAMER 1
- Three District Chiefs.

Call for additional resources early: It is recommended that the Incident Commander consider, upon confirmation of a working fire in a high-rise building, requesting a second alarm assignment. This recommendation is in order to operate as safely as possible, to accomplish all of the essential tasks at high-rise fire operations, and establish the necessary positions of the Command and Control System.

First Alarm Company Assignments

All referenced Command and Control assignments for the initial resource allocation assumes that the Incident Commander has determined that the modular framework of NIMS has progressed beyond Single Resources to Divisions/Groups.

All members are to be in full personal protective equipment (PPE) including SCBA prior to entering the building.

A. ENGINE COMPANIES

- All backup/exposure lines shall be equal to or greater in diameter than the primary attack line

I. FIRST ARRIVING ENGINE COMPANY: (Fire Floor)

First Arriving Engine Company Officer: The first arriving Engine Company Officer is responsible for the initial fire suppression operations on the fire floor. This Engine Company Officer may be assigned as a Supervisor of the initial Fire Floor Division (if the first Arriving Truck Officer is unavailable) at the discretion of the I.C.

Officer and two Firefighters
The Officer and two Firefighters of the first Arriving Engine Company will proceed into the building with a minimum of 200’ (four approved high rise packs of either 2” or 2 ½”) feet of standpipe hose packs and one standpipe equipment kit.

The first Arriving Engine Officer shall state initial hose line selection upon arrival on the assigned tactical channel.

Once the fire location has been established, the Officer should designate an Attack Stair. Selection of the Attack Stair should be based on what is the safest, closest, and fastest way to reach the fire. Smoke Towers should be avoided for use as the Attack Stair due to the possibility of an enhanced Stack Effect, and the potential dangers associated with a wind driven fire. In addition, Smoke Towers are designed specifically for evacuation of building occupants.

Attack lines shall not be hooked up on the fire floor. All attack lines are stretched from below the fire floor, preferably the floor below.

Engineer

The Engineer from the first Arriving Engine Company spots the apparatus as close as possible to the Fire Department Connection (FDC) and initiates appropriate primary water supply procedures (See Tactical Appendix-Water Supply Operations, Topic 2114.23).

2. SECOND ARRIVING ENGINE COMPANY: (Fire Floor)

Officer and two Firefighters

The Officer and two Firefighters from the second Arriving Engine Company will assist their engineer, if necessary, with the hose layout to complete the primary water supply.

The Officer and two firefighters from the second Arriving Engine Company then proceed into the building with a minimum of four 2” or 2 ½” standpipe hose packs totaling 200’, and one standpipe equipment kit (hose line selection will equal that of the first arriving Engine Companies unless extenuating circumstances dictate deviation which shall be announced on the tactical channel). The second Arriving Engine Company’s primary responsibility will be to join the first arriving Engine Company, and assist them with the initial attack hose line as directed by the I.C. If the initial hose line is 2”, and the primary attack line is in place the second arriving Engine Company may deploy a backup/exposure line once directed by the IC. This Engine Company will initially be a part of the Fire Floor Division, and under the direction of the
Division Supervisor (First Arriving Engine/Truck Company Officer). The second Arriving Engine Company may be re-assigned by the Division Supervisor or I.C. as necessary.

**Engineer**

The Engineer of the second Arriving Engine Company lays out the appropriate supply hose lines assisted by his/her crew if necessary. The Engineer spots the pumper apparatus at a hydrant, and initiates a tandem pumping operation, in order to complete the Primary Water Supply (See Tactical Appendix- Water Supply Operations, Topic 2114.23).

3. **THIRD ARRIVING ENGINE COMPANY: (Assigned by I.C.)**

**Officer and two firefighters**

Upon the direction of I.C. the third arriving Engine Company will proceed into the building with a minimum of four 2” or 2 ½” standpipe hose packs (totaling 200’), one standpipe equipment kit and any other tools as deemed necessary and be prepared to:

1. Proceed to a location two floors below the fire floor, and determine if there is a suitable location on this floor for staging
2. Relieve the first two Engine Companies operating on the fire floor.
3. Stretch, advance, and operate a backup line on the fire floor at the direction and request of the Division Supervisor and/or the I.C.
4. Stretch, advance and operate an exposure line on the floor above at the direction and request of the I.C. or Suppression Branch Director if assigned.
5. If and when this Engine Company stretches and operates a second attack hose line, they will be assisted by the fourth Arriving Engine Company, and will operate under the assigned Division Supervisor, Suppression Branch Director or the I.C.

**Attack lines shall not be hooked up on the fire floor. All attack lines are stretched from below the fire floor, preferably the floor below.** (Additional hose lines may have to be hooked up two floors below the fire floor.)

**Engineer**

The Engineer from the third Arriving Engine Company will spot the apparatus as close as possible to a second, interconnected Fire Department Connection (FDC), if one exists. If the building is not equipped with a second FDC, he/she will spot as close as possible to the FDC being used by the first Arriving Engine Company, and prepare to initiate appropriate secondary water supply procedures at the discretion of the Incident Commander. The Engineer of the third Arriving Engine Company may become the initial Water Supply Group Supervisor if deemed necessary.
necessary by the I.C. If assigned, the Water Supply Group Supervisor will coordinate all water supply operations, communicating directly with the Incident Commander (IC) or Exterior Branch Director. (See Tactical Appendix-Water Supply Operations, Topic 2114.23)

4. FOURTH ARRIVING ENGINE COMPANY: (Assigned by I.C.)

**Officer and two firefighters**

Upon the direction of I.C., the fourth arriving Engine Company will proceed into the building with the a minimum of four 2” or 2 ½” (hose line selection of the fourth assigned Engine Company will equal that of the third) standpipe hose packs (totaling 200’), one standpipe equipment kit and any other tools as deemed necessary and be prepared to:

1. Proceed to a location two floors below the fire floor, and determine if there is a suitable location on this floor for staging
2. Relieving the first two Engine Companies operating on the fire floor.
3. Stretching, advancing, and operating a backup line on the fire floor at the direction and request of the Division Supervisor and/or the IC.
4. Stretching, advancing and operating an exposure line on the floor above at the direction and request of the I.C. or Suppression Branch Director if assigned.
5. If and when the fourth Arriving Engine Company stretches and operates a second attack hose line, they will be assisted by the third Arriving Engine Company, and will operate under the assigned Division Supervisor, Suppression Branch Director or the I.C.

**Engineer**

The Engineer from the fourth Arriving Engine Company locates a secondary water supply (hydrant), and stands by at that location, prepared to complete the necessary hose layout to initiate appropriate Secondary water supply procedures if necessary, and upon orders from the Incident Commander. (See Tactical Appendix- Water Supply Operations, Topic 2114.23)

B. **TRUCK COMPANIES**

Depending on conditions upon arrival, arriving Truck Companies may be needed to complete rescue operations on the exterior. The Truck Company Officer should direct his/her engineer to spot the aerial or tower apparatus as appropriate, for any elevated rescue, or potential rescue needs, and secondary egress for firefighters operating inside the building. Consideration should be given to spotting on a corner of the building to maximize scrub area to two sides of the building. If an immediate rescue situation exists, the Company Officer will assign his/her members as appropriate, to effect rescue.
1. FIRST ARRIVING TRUCK COMPANY: (Fire Floor)

Officer, Engineer and two firefighters

The first Arriving Truck Company Officer will be the initial Incident Commander, if a District Chief is not on scene.

If no exterior rescue situation exists, the Officer two Firefighters, and the Engineer (if not assigned to operate the aerial apparatus) from the first Arriving Truck Company will proceed into the building with the necessary compliment of tools and equipment (See Tactical Appendix-Tools and Equipment Topic 2114.24)

During a PFAS or DFD Box alarm investigation, when no District Chief is on scene, the first Arriving Truck Officer will remain in the lobby area or fire command center if one exists. If a fire is confirmed during the investigation or the initial call is reported as a high rise fire, then the first Arriving Truck Company Officer may proceed to the fire floor and assume the Fire Floor Division Supervisor once the first arriving Chief is on scene, Command is transferred and is directed by the IC. The first Arriving Truck Officer will note the locations of alarm(s), any changes from a normal building condition from the fire panel or command center and obtain a set of building keys and communication handsets if available.

If fire is located above the sixth floor an elevator may be used to transport firefighters. The first Arriving Truck Company Engineer is assigned to become the Elevator Operator. (See Attachment A)

Members of the first Arriving Truck Company will initially be under the supervision of the first Arriving Engine Company Officer if the First Arriving Truck Officer has established Incident Command or is directed to remain in the command center upon the arrival of the first Arriving Chief.

Members of the first Arriving Truck Company may be required to provide; reconnaissance, forcible entry, primary search, rescue of occupants, pre-control overhaul, determination of the potential for wind driven fire conditions, establishment of firefighter areas of refuge, and if necessary, assist with the first hose line as directed by the assigned Division Supervisor or IC (especially in situations where the fire is discovered during a PFAS Class I or Box Alarm investigation, or if the second Arriving Engine is not expected to be on scene momentarily). Once an attack stairwell is selected, if the stairwell door is intact, the attack stairwell should be searched, while control of the fire floor door is maintained, at least 5 floors above the fire floor to clear the stairwell of people who are attempting to exit the building via the attack stairwell. Once the fifth floor above the fire floor is reached, members should call out to people in the
stairwell to make an effort to contact them if they are in the stairwell and assist them to safety or direct them to exit below the fire floor.

2. SECOND ARRIVING TRUCK COMPANY: (Assigned by I.C.)

Officer, Engineer and two firefighters

If no exterior rescue situation exists, the Officer, Engineer and two Firefighters, once assigned by the I.C. will proceed into the building with the necessary compliment of tools and equipment (See Tactical Appendix-Tools and Equipment 2114.24) and be prepared to:

A. Report to and establish an Interior Staging Area
B. Ascend to the floor above the fire and establish the assigned Division Supervisor and provide a Location, Conditions, Actions and Needs (LCAN Report) report to the I.C. with specific information regarding smoke or fire extension onto the floor above.
C. Be assigned to the Fire Floor Division Supervisor and assist with operations on the fire floor.
D. Be assigned to the area above the floor above the fire floor.

3. THIRD ARRIVING TRUCK COMPANY: (Initial RIT)

An Engine Company may be assigned RIT duties if a Truck Company is determined (by CAD) to be unable to meet the required response time.

If no exterior rescue operations are directed by the IC, the Officer, Engineer and two firefighters, from the third Arriving Truck Company/RIT will proceed into the building with the necessary RIT equipment and any additional compliment of tools and equipment (See Tactical Appendix-Tools and Equipment Topic 2114.24) as deemed necessary.

Once assigned by the I.C., the third Arriving Truck Company/RIT would proceed to a location on the floor below the fire to operate as the Initial RIT and conduct a RIT R.E.C.O.N.

C. SPECIAL OPERATIONS COMPANIES

1. RESCUE/HAMER COMPANY: (Assigned by the IC)

Officer, Engineer, and two firefighters

These companies will be assigned by the IC based on the specific rescue or Special Operations needs of the given incident or any other duties defined by the I.C.
If the Rescue/HAMER Company arrives prior to any Truck Companies (for example, in their immediate first Arriving response area), the Rescue/HAMER Company may assume the duties and responsibilities of the initial Truck Companies.

D. CHIEF OFFICERS

1. FIRST ARRIVING DISTRICT CHIEF: (Incident Commander)

The first Arriving District Chief will assume the position of Incident Commander. At the discretion of the Incident Commander, the initial command post may be established in the building's command center. Upon confirmation of a working structure fire, the IC should establish an exterior Command Post (CP) as soon as possible. This should occur as soon as the duties and responsibilities of Lobby Control/Systems are assigned. It is recommended that upon confirmation of a working fire, the IC consider requesting a 2nd alarm, and establish an appropriate Level II Staging Location.

2. SECOND/THIRD ARRIVING DISTRICT CHIEFS:

The Second/Third Arriving District Chiefs will report to the Command Post upon arrival and should anticipate the need to address the following Incident priorities and positions:

A. Lobby Control/Systems—an emphasis should be given to assigning these responsibilities to the Second Arriving Chief in order to address the tactical priority of reassigning the first Arriving Truck Officer to the Fire Floor.
B. Division/Group Supervisor
C. Branch Director
D. Safety Officer
### I. Water Supply Operations in Standpipe equipped buildings

#### A. High-rise / low-rise standpipe equipped building water supply procedures:

When buildings have systems that supply water for firefighting, they should be allowed to operate as they are designed. However, recognizing that building systems can and do often fail, the Denver Fire Department is committed to the early establishment of a fire department water supply system to buildings with standpipes and sprinkler systems.

When a building fire pump is present, no attempt should be made to overcome the fire pump unless:

1. It is confirmed that the building systems are not capable of supplying enough pressure and volume to attack lines, or
2. It is confirmed that the building fire pump has failed or failed to start.

If either of these situations occur, it is imperative that the Incident Commander identify and assign a Water Supply Supervisor to respond to the pump room to ascertain whether or not the failure of the system can be rectified.

When the fire department introduces high pressures into building systems early on, there is a high incidence of failure between the FDC and the fire pump room due to damage and stress to building piping and pipe joints. Engineers should always be cognizant to slowly increase pressure within the system when needed or requested. Engineers should always diligently monitor the incident tactical channel and be prepared to supply the building system with pressure as needed.

### II. Water Supply systems for standpipe equipped buildings are divided into two main building types:

#### A. Fire Pump equipped buildings.

Fire Pumps are often present in taller buildings, and some buildings with a large amount of square footage, such as large warehouses and complexes. These buildings often have PRV’s or PRD’s to manage pressure created by the fire pump. In these occupancies, the building’s pump system is intended to provide the primary water supply for firefighting at a pressure equivalent to what is needed at the top-most standpipe outlet. PRV’s on lower floors are set to operate at the correct pressure when the fire pump is on, pumping water at the required pressure. Therefore, fire department Engines must pump at least at the pressure the building’s fire pump will pump at, in order for PRV’s to operate correctly and supply the proper flow and pressure at outlet valves if the fire pump fails. In newer buildings, the placards on the
FDC state the pressure fire department apparatus should supply. This pressure is often surprisingly high. If the building is not equipped with a placard indicating the proper pressure, Engineers are directed to pump to the top floor utilizing the DFD pump chart for calculations. Extreme caution shall be utilized when pressurizing systems to this standard. Engineers must communicate with fire floor personnel to ensure that adequate pressures are achieved without over-pressurization.

1. Engineers should charge the system and remain at idle engine speed, with the apparatus in pump gear. Care should be taken to ensure the pump stays cool if no water is flowing through the apparatus pump for a period of time.
2. If the building fire pump fails or fails to start, The Engineer should supply the system with water and bring the pressure up slowly until the required pressure and flow are provided.
3. Final adjustments and fine tuning to supply pressure should be made after a supply is established and in communication with Fire Attack to perfect the supply to the hand line(s) operating on the fire.
4. If high pressures are anticipated, then supply hose lines to the building should be lashed together with webbing to prevent violent whipping if one line fails.
5. The engine located at the FDC should operate in pressure.

B. Buildings that do not have a fire pump.

Most of these buildings will have a domestic water supply that keeps the system charged, but may not be capable of producing the pressure and volume needed for firefighting. In these buildings, the fire department should be the primary water supply source.

1. Engineers should start by pumping to a range as listed on the DFD pump chart.
2. The Engineer should bring the pressure up slowly until the required flow is provided.
3. Final adjustments and fine tuning to supply pressure should be made after a supply is established and in communication with Fire Attack to perfect the supply to the hand line(s) operating on the fire.
4. The engine located at the FDC should operate in the pressure setting.

III. The Denver Fire Department high-rise water supply operations are divided into two categories: Primary water supply and Secondary water supply (when applicable).

A. Primary Water Supply Procedures:
The first two engine companies on scene and their respective Engineers will be responsible for establishing the primary water supply.

1. First-arriving Engine Company:

The first-due engine company Engineer should spot his/her engine as close as possible to the building’s fire department connection (FDC) and will provide a minimum of two 3” supply lines from the engine to the FDC. 2-1/2” hose is not considered water supply hose, and should not be used for connecting to an FDC.

If the building has a two-inlet FDC, the Engineer should attach a clappered siamese to one of the inlets on the FDC. This will establish a third inlet for the water supply which can be used by the 3rd arriving Engine to establish an initial secondary supply.

This Engineer then prepares to receive supply lines from the Engineer of the second-arriving engine company.

Supply lines to the building’s system should be charged as soon as it becomes apparent that a working fire is present.

The building’s system should then be supplied based on a determination of which type of supply system is present (fire pump / PRV’s vs. no fire pump) and according to the recommendations listed in water supply system types above.

2. Second-arriving Engine Company:

The second-due engine company Engineer (assisted by their crew if necessary) should reverse lay/hand jack the appropriate supply lines to complete the primary water supply. This will include a minimum of two 3” supply lines from engine-to-engine and should include a 35’ 5-inch supply connected to a hydrant.

All supply lines should be charged with water up to the first-arriving engine company at the FDC once it is confirmed that the first engine is prepared to receive water. When pressure is needed or requested, it should be brought up slowly to the correct setting. Both Engineers should communicate with each other to achieve the desired result. The engine located at the hydrant should start in volume, but may have to changeover to pressure if needed.

B. Secondary Water Supply Procedures:
A secondary water supply should be established at working fires that are not quickly brought under control.

The third and fourth-arriving engine companies and their respective Engineers will be responsible for establishing the secondary water supply.

**The third arriving Engine Company Engineer may become the initial Water Supply Group Supervisor once assigned by Command.**

Secondary water supply should be considered a dynamic process. The procedures listed below should be followed as stated, but companies may need to make adjustments to accommodate changing conditions on the fire ground which could require changes to the guideline as stated.

1. **Third-arriving Engine company:**

   If the fire building is equipped with a second FDC (interconnected), the third-arriving engine company Engineer should spot his/her engine at this second location and follow the same procedures as those for the primary water supply.

   If the fire building is equipped with only one FDC, the third-arriving Engine Company Engineer should spot his/her engine next to the building’s FDC. This engine should be located near the first-due engine. One 3” supply line should be stretched and attached to the open inlet on the clappered siamese placed by the first-arriving Engine Company.

   Actions that require hose lines going into the building to the first floor standpipe should be cleared by the Exterior Branch Director or Incident Commander prior to implementation. If the fire does not come under control quickly, the Engineer should locate a first floor standpipe hose valve connection and if it’s not equipped with a pressure reducing valve (PRV), he/she should stretch two 3” supply lines to this location. A clappered siamese, along with the proper adapters, should be attached at this location in order to establish two inlets for supply. If PRV’s are present then the Engineer should check the floor above for the presence of PRV’s and determine if an alternate supply is possible there. If not, the Engineer should stand by and be ready to take over for the primary FDC supply engine if that pump fails. In the mean time, supply the clappered siamese connected to the FDC by the first engine.

   The Engineer should be prepared to receive supply lines from the fourth-arriving engine company.
2. Fourth-arriving Engine Company:

The fourth-arriving Engine Company Engineer (assisted by their crew if necessary) will reverse lay/hand jack the appropriate supply hose lines to complete the secondary water supply. This will include a minimum of two 3” supply lines from engine-to-engine and should include a 35’ 5-inch supply connected to a hydrant.

All supply lines should be charged with water up to the third-arriving engine company at the FDC. The engine located at the hydrant should start in volume, but may have to changeover to pressure if needed.
Tool and Equipment requirements/recommendations for High Rise incidents are listed below by Company type:

I. 1st Arriving Engine Companies:

   A. Full PPE and SCBA
   B. Initial attack line selection:
      1. 200’ Minimum of 2” or 2 ½” hose (3 standard high rise packs plus 1 nozzle pack)
      2. Smooth Bore Nozzle – 1” (for 2”) or 1 1/8” (for 2 ½”) minimum tip size
      3. Standpipe Equipment Bag
   C. Set of Forcible Entry/Exit Irons (optional)

II. 2nd Arriving Engine and all subsequent Engine Companies:

   A. Full PPE and SCBA
   B. Initial attack line selection:
      1. 200’ of 2” or 2 ½” hose (3 standard high rise packs plus 1 nozzle pack, or 2 standard high rise packs plus 2 nozzle packs). Engine companies may use their discretion to configure two nozzle packs vs. one.
      2. Smooth Bore Nozzle – 1” or 1-1/8” minimum tip size depending on hose line selection
      3. Standpipe Equipment Bag
   C. Set of Forcible Entry/Exit Irons (optional)
   D. Spare SCBA air cylinders (optional – consider if after 2nd due)

III. Hose Packs and Standpipe Equipment Bag Configuration

   A. The Denver Fire Department requires a standardized configuration for high rise hose packs (2” and 2 ½” hose), nozzle section packs and the standpipe equipment bag. This configuration is the only authorized arrangement approved by the Department. Set up your equipment per the photos and description listed below:
Start with the female coupling end with fold line and “HR” marking.

The first fold is at the “HR” mark when making a hose pack.

Hose is folded in a horseshoe pattern with the first fold going to the right of the female coupling and the second fold going to the left. This process is continued throughout while making the hose pack. (Picture for illustration only)
Two members assemble the pack, one on each side. They hold the pack tight as the hose is folded in the horseshoe. 1 member works the top of the pack, and the other works near the couplings.

Folds stop short of the coupling and are staggered to keep the pack compact at the coupling end.

Hose left at the end is used as “tail” to protect the male coupling and facilitate hook-up at the drop point during deployment. Tail length, from the end of the folds to end of the coupling shall not exceed 24” so as not to become a hazard.

The male coupling is connected to the female coupling. A few threads is ok, it doesn’t need to be tight to the gasket.
The hose pack is then flipped up on its side to keep it tight and two straps are applied to the male coupling side. This is important for deployment. Note that the top strap is placed to the male coupling side at the top of the horseshoe.

The pack is flipped over on the other side and the 3rd strap is applied. The pack should be stored like this. Note; the straps near the couplings are placed close to the end of the pack to maintain compactness.

If there is excess hose left at the end of the pack, such as may be the case when making the nozzle section, adjust the male coupling to the desired position and …….
Note: Initial attack systems incorporating the use of a 2-1/2” x 1-1/2” gated wye and a short leader section of 2-1/2” or 3” hose are prohibited for use by the first and second due Engine Companies unless authorized by the I.C. This equipment may be utilized by later arriving companies as deemed necessary by the IC or Suppression Branch Director.

The Denver Fire Department will no longer authorize the use of separate Standpipe equipment bags for 2” and 2 ½” hose lines. The only authorized equipment bag will be equipped as stated below. The in-line pressure gauge shall be utilized on all handline deployments regardless of hose size.

B. Standpipe Equipment Bag Contents:
1. Spare Nozzles with 1” and 1-1/8” Tip. ½” Overhaul Tip
2. In-line Pressure Gauge
3. 2 – 60 degree Elbows
4. Door Search Straps
5. Door Wedges
6. Door Marking Equipment
7. 1 ½” to 2 ½” Increaser
8. 2 Lightweight Spanner Wrenches
9. Aluminum Pipe Wrench, (Spare Control Wheels, if possible)
10. Threaded Adapters. 2-1/2” and 1-1/2”
11. Wire Brush

1” Smooth Bore Tip 210 GPM @ 50psi and 1 1/8” Smooth Bore Tip 266 GPM @ 50psi

2 ½” In-line Pressure Gauge
Mark as shown:
- Company designation
- Add 5 psi per floor above standpipe outlet
- 2”- 100 FT 80PSI
- 2”- 150 FT 95PSI
- 2”- 200 FT 110PSI
- 2 ½”-150 FT 65PSI
- 2 ½”-200 FT 70PSI
- 2 ½”-250 FT 75PSI

2 ea. 2 ½” 60 degree elbows
Door strap search marker
Light weight tape holds about 5 together.

Door wedges stacked together in the bottom of the bag.
IV. **Truck Companies:**

A. Full PPE and SCBA  
B. Truck Companies are not required to carry hose, nozzles or standpipe equipment bags.  
C. The duties of truck companies at these incidents include search, rescue, forcible entry, ventilation, overhaul, and utility control. Tools that are needed for these tasks should be considered and as such a standard compliment of tools should include the following:  
   1. Set of forcible entry / exit irons (striking tool and prying tool)  
   2. Pike pole or hook (pulling tool). Short or long, selected for occupancy and task.  
   3. Hydraulic forcible entry tool. (Hydra Ram / Rabbit Tool)  
   4. Search rope / tag line  
   5. Thermal imaging camera  
   6. Elevator key set  
   7. Water can or light water extinguisher (consider for residential occupancies)  
   8. Spare air cylinders (optional)

V. **Special Operations Companies:**

A. Full PPE and SCBA  
B. Special Operations Companies are not required to carry hose, nozzles, or standpipe equipment bags.  
C. At the direction of the IC or their designee, the Special Operations Companies can provide unique and specialized equipment and capabilities. In addition to the standard compliment of truck tools, they should bring the following:  
   1. Rescue 1
1. Rescue rope bags and equipment
2. Rotary saw with a metal cutting blade
3. Other specialized tools as needed

2. HAMER 1
   1. RIT bag
   2. Quad gas meters
   3. HCN meters
   4. Other metering equipment as needed
   5. Other specialized tools as needed

VI. Rapid Intervention Team
   A. Full PPE and SCBA
   B. Set of Irons (forcible entry tools)
   C. Hydraulic Forcible Entry Tool (Hydra-Ram / Rabbit Tool)
   D. Pike pole (short for residential, long for commercial)
   E. Search Rope
   F. Set of Elevator Keys
   G. Thermal Imaging Camera (TIC),
   H. RIT Pack and RIT Search Ropes
   I. Stokes Basket
I. LOBBY CONTROL / ACCOUNTABILITY

The Lobby Control is responsible for:

A. Tracking the accountability of all companies and personnel that enter and exit the building according to the Operations / Safety / Personnel Accountability System SOG (Topic # 2110.03). The establishment of Level II Accountability should be anticipated and put in place early on. Duties include:
   1. Collection and management of ID Tags from all members entering the building.
   2. Confirmation that any fire department member going above the main floor of the fire building:
      a. Has been assigned into the building
      b. Is wearing PPE
      c. Has checked in with the Fire Command Center and received the necessary equipment
      d. Checks out with the Command Center to return all building equipment and keys prior to exiting.

B. Monitoring and control of the Fire Command Center and Building Systems.

As the incident develops, the assigned Lobby Control/Systems Supervisor may select an Officer or Company and assign the duties of the Lobby Control to them. Once Lobby Control is transferred, the assigned Lobby Control /Systems Supervisor may assume the remaining duties and responsibilities of the Lower Floor Branch Director which will include:

C. Assignment, monitoring and control of elevators
D. Control of all building access points and direction of personnel to correct routes
E. Control of stairways and direction of building occupants to proper exits
F. Firefighter access for ventilation
G. Equipment support operations
Communications are a major concern at a high-rise incident. Information collection and dissemination can be accomplished by efficiently using the various systems available. These systems include:

I. Fire Department Radios - A two-way communication system with various channels that allows communication between companies, commanders, and dispatchers. The most commonly used channels are the radio-to-radio and the district repeater. Limitations of this system may include poor reception due to building design or location within the building.

II. Firefighter Handsets – A two-way communication system installed in the building which allows a firefighter at a remote location to plug the handset into a phone jack and talk to the Fire Command Center. Phone jacks are located by pull stations, elevator lobbies, and in elevator cars. Fire Warden Phones, which are hard-wired, are part of this system. They are found in mechanical rooms and elevator rooms. Limitations of this system include one-way initiation of the call (the Fire Command Center cannot initiate the contact), number of calls the system or the Fire Command Center personnel can handle, and possible mechanical failure due to fire conditions.

III. Building PA (Public Address Systems) – A one-way communication system installed in the building that allows the Fire Command Center personnel to make announcements to all or parts of the building. These systems are normally used to make announcements to occupants in the building.

IV. Building Security and Maintenance Radios – A two-way communication system present in the building normally used by building personnel in their daily routines. Often their radios work more efficiently than the Fire Department radios. A security or maintenance person in the Fire Command Center can be used to relay information to other areas of the building through other building personnel.

Fire Department radios, intercoms, and firefighter handsets will be used for operation purposes, and building radios may be used for maintaining and operating building systems, with the assistance of building engineers.
FIRE PROTECTION SYSTEMS / BUILDING SYSTEMS
The following systems are often present in high rise buildings.
Many of these systems can be supervised in the Fire Command Center (FCC).

I. Automatic Fire Protection Systems
   A. Standpipes
   B. Sprinklers
   C. Fire Pumps

II. Fire Alarm Systems
    A. Fire Alarm Panel
    B. Manual Pull Stations
    C. Audible and Visible Notification

III. Fire Detection Systems
     A. Smoke Detectors
     B. Heat Detectors
     C. Beam Detectors

IV. Communication Systems
    A. Firefighter Telephones / Handsets
    B. Refuge area Intercoms
    C. One-Way Communications (public address system)
    D. Bi Directional Amplifiers (BDA’s) – sometimes referred to as “building repeaters”

V. Smoke Control Systems
   A. Stairway and Elevator Pressurization
   B. Exhaust Systems

VI. Emergency Power Systems
    A. Generators
    B. Battery Banks
A fire in a high-rise building may require that equipment be transported to the fire area. It may be necessary to utilize and elevator or establish a Equipment-Stairway Support Team for the movement of equipment.

If the Incident Commander or Lower Floor Branch Director authorizes the use of an elevator to assist with the movement of equipment, the use of the elevator will be in compliance with the Elevator Operations (SOG-2111.17-Attachment A) Guideline.

Equipment Support Operations take a variety of forms:

I. **Relay Operations:** One firefighter is assigned to each floor in the stairway. A company of four persons can cover four floors, and ten companies can supply 40 floors. Each firefighter is responsible for transporting any equipment that arrives on that floor up to the next floor. Each firefighter has all PPE available. Benefits of this method include reduction in the amount of physical strain on the firefighters compared to climbing the entire building; a continuous chain that can continually move equipment is formed; and communication between companies is maximized. Drawbacks of this method include the chain cannot start operation until all links in the chain are present and ready; it takes a long time to set up; it requires more staffing; and a breakdown in one link of the chain can cause equipment movement to slow down or stop.

II. **Entire Trip Operations:** Companies are assigned to take specific equipment to the fire area. Members must wear all PPE. Major benefits of this operation are that equipment is quicker to arrive on the fire floor, the system can be set up and operational soon after arrival on scene, and it takes fewer members to operate. Drawbacks include the physical strain on individual firefighters, sporadic equipment arrival on the fire floor, diminished communication between companies, and the limited amount of equipment that can be carried by each firefighter.

It is very important that Company Officers within the Equipment Support chain monitor their crew members throughout the operation for dehydration and fatigue. This operation will be extremely demanding and will require firefighters in top physical condition.
An ALS ambulance and Supervisor will be dispatched to all high-rise incidents. Major high-rise incidents may require the Incident Commander to establish a Medical Branch, in accordance with NIMS. By establishing a Medical Branch this will allow for the Branch Director to order additional resources along with being able to utilize a separate radio channel. The first-arriving ambulance team or supervisor will report to the Level II Staging Area (if established) or IC for assignment. The Incident Commander will approve the location for triage.
I. The Denver Police Department will dispatch units requested by the Incident Commander to the scene of a high-rise incident. Their responsibilities may include:
   A. Traffic Control
   B. Crowd Control
   C. Landing Zones and Air Space control for Helicopter Operations
   D. Protection of the Command Post and other Fire Department Areas
   E. Security at the Exterior Staging Areas
   F. Establishment and Maintenance of Zones and Perimeters
   G. Other Assistance as Requested by Incident Command

II. Security of the scene is under the control of the Denver Police Department. The Police Commander will report to the Command Post upon arrival. Police Department personnel will not be allowed in areas or situations that expose them to smoke or fire.
PURPOSE: To provide a procedural overview of collapse rescue considerations applicable to first responders and members of the Collapse Rescue Team.

SCOPE: Applies to all Denver Fire Department personnel functioning in an operational capacity at collapse training and collapse rescue incidents.

CAUTION: At all technical rescue incidents, caution should be used because of the high risk/low frequency of these types of calls. All responders should be cognizant not to exceed their level of training or the ability of the tools that they are issued. However, due to factors beyond our control (Technical Rescue Team assigned to another call, delayed response of Technical Rescue Team, etc.), first-in companies and/or the Incident Commander may feel compelled to have personnel operate beyond their level of training. If this is the case, extreme caution should be used and deviating from this SOG should be the exception rather than the norm. Furthermore, operating beyond levels of expertise should only be attempted after completing a thorough risk/benefit analysis and only when a civilian or firefighter’s life is in imminent danger. As always, safety of responders should be a primary consideration, but especially in these instances. SAFETY, SAFETY, SAFETY!!

DEFINITIONS:

Collapse Rescue Response – 1 Engine, 1 Truck, 1 District Chiefs, and the Collapse Rescue Team (Rescue 1, Tower 1, Collapse Trailer, HAMER 1, and Engine 1).

Communications – Designated radio channels, air horn, hand signals, marking tape, and spray painted markings.

Denver Fire Department Fire Protection Engineer – A Fire Prevention Division Engineer that specializes in Structural engineering and building stability and he has access to specialized equipment (total station).

Escape Routes – One or more passages from the operations area that are the fastest and safest way out.

Hailing System – Search personnel are placed approximately twenty five to fifty feet apart in safe locations. The Team Leader signals for silence all, work is stopped. In a clockwise rotation each searcher calls out loudly stating, “If you can hear me call for help or tap five times on the structure.” All personnel listen and try to fix the victim(s) position.
LCES – An acronym standing for Lookouts, Communication, Escape Routes, and Safe Areas.

Lock Out / Tag Out – Procedures ensuring that all electrical, mechanical, and heavy equipment at or near the rescue site are turned off and physically prevented from being inadvertently turned back on.

Lookouts – One or more persons with good understanding of the operations involved (e.g. Safety Officer, Fire Prevention Building Engineer).

Safe Areas – A place within a collapse zone capable of withstanding further collapse; might have to be built by the rescue crews.

Shoring – The process of placing material such as posts or building columns inside a building or raker shores on the outside to help support and or to stabilize the structure.

I. FIRST RESPONDER RESPONSIBILITIES

A. Establish Incident Command and start building the command structure as the situation dictates and as resources allow. Implement use of the IAP/Site Safety Plan specific to collapse rescue.

B. Conduct a comprehensive size-up, taking notice of building construction, type occupancy, and the number of stories. Attempt to locate a responsible party and/or witness(s) to determine what happened, known hazards, and possible victim locations within the structure or the periphery.

1. First in company(s) when spotting their apparatus need to consider secondary collapse.
2. If not dispatched on the first assignment, the Collapse Rescue Team needs to be called for at this time

C. Survey and secure the area to include the following:

1. Establish a water supply if necessary.
2. Try to identify and mitigate hazards, taking into consideration potential conditions and problems:
   a. Collapse zones
   i. Manage foot traffic, both civilian and rescuers
ii. Establish a perimeter for the collapse zone (rescue area) keeping all incoming civilian personnel out.

b. Locate and control utilities as necessary (electrical, gas, and water)
   i. Lock Out / Tag Out equipment as necessary, and as possible. When de-energizing or turning off electrical and or mechanical equipment, it is critical that members know what is affected and the function of that equipment.
   ii. Air monitoring should be started at this time if there is any evidence or probability of a gas leak.

c. Take into consideration snow loads and water leaks.

D. Monitor the collapsed structure for stability. If necessary call for a DFD Fire Protection Engineer and/or a Denver Building Department representative through the Fire Dispatcher for assistance.

Consideration must be given to secondary collapse, hazmat, and fire.

E. Attempt to establish communication with the victim(s) and determine as much information as possible (e.g., medical condition, what happened, when it happened, why it happened, etc). Such information can be critical in devising a rescue plan.

F. Rescue

1. Visible victims in the collapse zone should be encouraged to self rescue if at all possible.

2. Staging and triage areas should be established as soon as possible for victims that have self rescued and any additional victims.

3. The hailing system should be used at this time to locate lightly trapped and concealed victims.

4. Prior to attempting any rescue of lightly trapped or concealed victims, the building/area must be determined stable by the Fire Protection Engineer or the Collapse Team.
II. COLLAPSE RESCUE TEAM RESPONSIBILITIES

A. Gather information from the first responding crews.

B. Assist the Incident Commander, as directed, in building out the command structure to accommodate special operations.

C. Determine if additional technical teams/resources are necessary.

D. Establish a plan and a back up plan for stabilization and rescue. Determine the proper level of Personal Protective Equipment and start using LCES (Lookouts, Communication, Escape Routes, Safe Areas).

E. Establish and identify the technical, entry, backup, shoring, and cut teams.

F. Stabilize building or the area prior to entry.

G. Determine if continued monitoring is needed and what monitoring instruments are required for stability.

H. Rescue crews should keep in mind that during collapse rescue operations such as breaching walls, floors, roofs, and making entry into those spaces, the rescue can transition into a confined space rescue.

PURPOSE: To provide a procedural overview of confined space rescue considerations applicable to first responders and members of the Confined Space Rescue Team.

SCOPE: Applies to all Denver Fire Department personnel functioning in an operational capacity at confined space training or rescue incidents.

CAUTION: At all technical rescue incidents, caution should be used because of the high risk/low frequency of these types of calls. All responders should be cognizant not to exceed their level of training or the ability of the tools that they are issued. However, due to factors beyond our control (Technical Rescue Team assigned to another call, delayed response of Technical Rescue Team, etc.), first-in companies and/or the Incident Commander may feel compelled to have personnel operate beyond their level of training. If this is the case, extreme caution should be used and deviating from this SOG should be the exception rather than the norm. Furthermore, operating beyond levels of expertise should only be attempted after completing a thorough risk/benefit analysis and only when a civilian or firefighter’s life is in imminent danger. As always, safety of responders should be a primary consideration, but especially in these instances. SAFETY, SAFETY, SAFETY!!

DEFINITIONS:

Confined Space – An area with limited access and egress. Confined spaces include, but are not limited to, tanks, pipes, culverts, voids in structural collapse debris, vaults, or any area not designed for continuous occupation.

Confined Space Entry Permit – A written or printed document typically constructed by an employer authorizing entry into a permit-required confined space that designates the requirements for entry (e.g., space to be entered, purpose of entry, personnel entering, hazards of space, acceptable entry conditions, layout of the space, entrance/egress points, etc.).

Confined Space Response – One engine, one truck, one district chief, and the Confined Space Team (Rescue 1, Tower 1, Collapse Trailer, Hamer 1, and Engine 1).

Lock Out / Tag Out – Procedures ensuring that all electrical and mechanical equipment at or near the rescue site is turned off and physically prevented from being inadvertently turned on (or off in the case of needed ventilation or lighting, for example).
**DENVER FIRE DEPARTMENT**

**STANDARD OPERATING GUIDELINE**

**Section:** OPERATIONS: SPECIAL OPERATIONS

**Topic:** CONFINED SPACE RESCUE

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**Low-Profile Maneuver** – A maneuver requiring the removal of the member’s SCBA harness and air cylinder in order to gain entry into a confined space.

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**I. FIRST RESPONDER RESPONSIBILITIES**

A. Establish Incident Command and start building the command structure as the situation dictates and as resources allow. Implement use of the IAP/Site Safety Plan specific to confined space.

B. Conduct a comprehensive size-up of the incident. Verify that the incident is a confined space operation. Confirm that the confined space team is responding. In the event of an unstable structure, confirm the response of the Fire Department Fire Protection Engineer. Locate responsible party and entry permit. Interview witnesses and/or responsible party to determine known hazards and the victim’s location.

C. Determine level of PPE and secure the area.

Establish the need to:

1. Monitor air.
2. Shut down utilities.

   Lock Out / Tag Out equipment as necessary, and as possible. When de-energizing or turning off electrical and/or mechanical equipment, it is critical that members know what equipment is affected and the function of that equipment.

3. Create a hot zone.
4. Secure a water supply.
5. Determine stability of the area.

D. Attempt to establish communication with the victim(s) and determine as much information as possible (e.g., medical condition, what happened, when it happened, why it happened, etc.). Such information can be critical in devising a rescue plan.

E. Determine if an operations level rescue can be attempted. Rescue should only be attempted after considering the following:
1. Victim must be line-of-sight.
2. Entry opening must be large enough for rescuer to enter with full PPE in normal position.
3. Vertical entry of 8 feet or less.

F. Rescue shall not be attempted if the following exists:

1. If victim can not be seen.
2. If rescuer PPE must be removed or repositioned to enter confined space, including the SCBA low profile maneuver.
3. If hazardous chemical involvement.
4. If vertical entry requires a rope system or is greater than 8 ft.

G. Once an operation level rescue has been determined as feasible, develop a rescue plan. The plan must include:

1. Monitoring and recording of atmospheric conditions in the confined space, to the degree possible without entering the space, using meters available.

   Once the need for monitoring is established, it must be continued for the rest of the incident.

2. Ventilation considerations prior to entry
   a. Only ventilate if the atmosphere in the confined space is at or near the explosive limit (50% Lower Explosive Limit). Ventilation team must take into consideration where the atmosphere from the confined space is exhausting to.
   b. Ventilation should not be started when the atmosphere is enriched beyond the Upper Explosive Limit until the victim(s) and rescuers are clear of the area (ventilating an atmosphere enriched beyond the Upper Explosive Limit will introduce oxygen and, thus, bring it into an explosive range).

3. Rescue considerations
   a. Number of rescuers needed.
   b. Rescue plan must include a rescue team as well as a back up team.
c. Considerations should include packaging and extraction of the victim and the team.

*Note: 60 percent of all deaths in confined space incidents are would-be rescuers.*

II. CONFINED SPACE TEAM RESPONSIBILITIES: TECH. LEVEL

A. Gather information from the first responding crews.

B. Assist the Incident Commander, as directed, in building out the command structure to accommodate special operations.

C. Determine if additional technical teams/resources are necessary.

D. Determine if continued monitoring is needed and what monitoring instruments are required.

E. Establish and implement a ventilation plan.

F. Determine the proper level of Personal Protective Equipment.

G. Establish and identify entry teams and backup teams.

H. Review confined space entry permit (if one exists) to determine as much information as possible regarding the space.

I. Establish an entry team plan (Rescue Team Alpha) and backup team plan (Rescue Team Bravo).

J. Locate and assess the victim(s) with the following considerations:

   1. If the victim(s) is critical and/or the environment unstable, the victim(s) should be removed immediately.
   2. If the victim’s condition and environment permit, he/she should be treated and stabilized as necessary before removal.

K. Package and remove the victim(s).

**ATTACHMENT:** Confined Space Rescue IAP/Site Safety Plan. Also available at: DFD Web Home Page / Downloadable Forms / Operations / Confined Space
PURPOSE: To provide a procedural overview of hazardous materials isolation and mitigation considerations applicable to first responders and members of the Hazardous Materials Team

SCOPE: Applies to Denver Fire Department personnel functioning at Operations Level (Level 1) capacity, and will define Technician Level (Level 2) entry for hazardous materials incidents involving known and unknown products.

I. FIRST RESPONDER RESPONSIBILITIES

A. Establish Incident Command and start building the command structure as the situation dictates and as resources allow.

1. First Assistant Chief on scene shall implement the use of a Site Safety Plan. This plan is to be updated and consistent with all operations going on throughout the incident. This plan can be delegated to the Rescue/Safety Officer in expanded incidents.

2. Conduct a comprehensive size-up of the incident. Verify that the incident is a hazardous materials incident. If it is determined that the incident is within the scope of Operations (Level 1) procedures, first in companies shall initiate the appropriate mitigation techniques. Operations Level (Level 1) procedures include hazard mitigation of fuel spills, natural gas, and propane leaks. For all other hazmat incidents beyond Operation Level (Level 1), a full hazmat response (Level 2) shall be requested. A full hazmat response (Level 2) includes all these companies: Hamer 1, Engine 6, Rescue 1, Engine 9, Tower 9, and the Decon Rig. Initial crews need to secure and isolate the area and begin the process of setting hot, warm, and cold zones.

3. Locate any witnesses to said event and determine initial exposure/casualties.

4. No rescue attempts should be made into the Hot Zone without utilizing full PPE, SCBA, and having emergency decontamination procedures established.

II. HAZARDOUS MATERIALS TEAM RESPONSIBILITIES
A. Once positive identification of a hazardous material (either known or unknown) as a solid, liquid, or gas has been established, the Denver Fire Department Hazardous Materials Team will be deployed into action.

For special events, a Joint Hazardous Material Assessment Team (JHAT) will be utilized to determine level of response and initiate the Incident Command System if a credible threat is determined. If the situation can be handled by the JHAT, then they will do so without scaling up the incident. The JHAT will confer with the Branch Directors from their organization first, prior to any mitigation efforts.

B. Once the HazMat Team arrives on scene, the Officers from Engine 6, Hamer 1, and the Decon Group Supervisor will all meet with the Incident Commander to determine method of entry, mitigation, and decontamination and gather as much information as possible from first responding crews.

C. Hazardous Materials Branch Director and Entry Group Supervisor will formulate an Incident Action Plan for the mitigation of the material that meets the objectives and strategy of the Incident Commander.

D. Initial actions to be done prior to entry are as follows:

1. Monitor air.
2. Identify and confirm symptomatic condition of patients.
3. Shut down utilities, if needed.
4. Confirm that initial Hot Zone is sufficient and define the Hot Line and Decontamination Reduction Corridor.

E. Determine what the chemical or material is whenever possible.

1. Locate U.N. identification number.
2. Obtain Material Safety Data Sheets (MSDSs).
3. Research chemical and physical properties of product, if available.
4. Get 10-minute updates on wind direction, speed, and temperature.
5. Locate a responsible party for the layout of the building to gain helpful knowledge for entrants. This helps reduce reflex time to target.
6. Locate NFPA 704 placard on building, if applicable.

F. Determine the proper level of Personal Protective Equipment. This process shall be determined by the Resource Technical Specialist and
confirmed by Entry Group Supervisor and HazMat Branch Director, based on reliable information received about the chemical or material.

G. Establish and identify entry teams, back-up teams, and rescue teams. Teams will be identified as Alpha Team, Bravo Team, etc.

H. All members who are going to be engaged in entry need to have pre-entry and post-entry medical screens, performed by the Medical Officer.

I. Confirm that Decon Reduction Corridor is in place and is operational. No entry of any type will be done without Decon being in place.

J. Once the Action Plan is set, all members will be given a safety briefing of the goals, actions, and abort criteria regarding the mission.

K. All communications with the Entry Team will be done through the Entry Group Supervisor, operating on a separate, dedicated channel.

L. Once the problem has been reconn and/or mitigated, the Entry Team will exit through the reduction corridor and a debriefing of events will occur. If needed, the Bravo Team will be sent in for the second entry.

If multiple entries are to be made, the HazMat Branch Director and Entry Group Supervisor will utilize and configure teams to maximize goal outcomes and reduce fatigue of the entrants.

M. Contact Special Operations Chief for cost recovery and code enforcement early in the incident.

REFERENCES: None
PURPOSE: To provide a procedural overview of the decontamination procedures at a hazardous materials incident applicable to Decontamination Team and all Denver Fire Department personnel assigned to assist with decontamination at a hazardous materials emergency.

SCOPE: Applies to all Denver Fire Department personnel functioning either at Operational Level (Level 1) capacity or Technician Level (Level 2) capacity at a hazardous materials response where Decon may be performed.

RESPONSE: At any incident that requires an involved decontamination process, a Full Hazmat Response (Level 2) shall be initiated by Dispatch or the Incident Commander. This Full Hazmat Response (Level 2) includes the following companies: Hamer 1, Engine 6, Rescue 1, Engine 9, Tower 9, and the Decon Rig.

I. TYPES OF DECONTAMINATION

A. Gross Decontamination: A corridor established to create a water shower to cleanse people leaving a large venue or location after a suspected hazardous materials release. This can be accomplished by utilizing fire apparatus, nozzles, or any device that will create a significant water flow to wash contaminates off clothing or exposed body areas.

B. Mass Decontamination: The decontamination of large numbers of people in the event of industrial, accidental, or intentional release of a toxic, caustic, polluted, or otherwise unhealthy or damaging substance. This is to include any chemical, biological, or radiological product intentionally released to harm first responders or the general public. Mass decontamination will be completed with large tents, which will include an un-dress and re-dress area. This decontamination will also require additional resources due to the need of patient accountability and potential for extended operational periods.

C. Technical Decontamination: A decontamination corridor established to remove or neutralize hazardous materials from first responders who have gone down range at a hazardous materials emergency. Technical Decontamination will necessitate an establishment of hazard zones, a well.
defined decontamination reduction corridor, and proper analysis of product for decontamination solution and appropriated PPE.

D. Emergency (Cut and Run): A rapid decontamination of a victim or first responder who has been contaminated at a hazardous materials emergency. At a minimum, a hoseline off of an engine is required; at a maximum, a full decon line should be established.

E. Self Decontamination: This is in effect for the last scrubbers leaving the decontamination reduction corridor. This process will have the first responders remove any potential contaminates from their person before exiting into the warm zone.

F. Dry Decontamination: The process of brushing contaminates off a person or first responder at a hazardous materials emergency without a decontamination solution. This is accomplished by the Scrubbers and will necessitate the use of meters or assessment materials to confirm that the person has been successfully decontaminated.

G. Non-Ambulatory Decontamination: The decontamination of people who do not have the ability to walk through a decontamination line. This will encompass the use of a tent and the non-ambulatory roller system to assess and decontaminate the person. This process will require additional resources due to the intensive nature of non-ambulatory decontamination.

II. COMMUNICATIONS

Communications will be completed through the chain of command from the Decontamination Liaison Officer through the Decontamination Operations Officer. Decontamination Officer and Tower 9 Engineer will monitor the radio channel designated for the Haz-Mat Entry Team and keep the Scrubbers updated on teams sent down range and their progress. If necessary, the Scrubbers and Decontamination Operations and Safety Officers will select a separate radio channel to conduct transmission of pertinent information to the Decontamination Team members.

III. CONTAINMENT AND RUN-OFF

Decontamination Team members at all times need to be aware of product containment and the potential for product run-off at a hazardous materials
emergency. If the product has exceeded or manages to get into a public sewer, waterway, or an area affecting public health, Special Operations will be contacted and the proper agency will be notified to mitigate.

IV. DISPOSAL

All contaminated clothing and equipment will be left at the scene and disposed of by a professional hazardous materials contractor. This includes SCBAs, bunking gear, monitoring equipment, decontamination tents, and any equipment deemed contaminated by the Incident Commander, Haz-Mat Branch Director, and Decontamination Liaison Officer. Any decontamination issues with regard to firearms will be dealt with by the Incident Commander, Decontamination Liaison Officer, and the affected agency.

V. OPERATIONS LEVEL (LEVEL 1) RESPONSIBILITIES

A. Identify that the emergency deems a hazardous materials response.
B. Establish Incident Command.
C. Conduct a thorough size-up of the scene and attempt to locate a responsible party and/or witnesses and determine what happened and if there are any possible victims; isolate area and begin any necessary evacuations.
D. Proceed with any gross or emergency decontamination.
E. Utilizing appropriate hazmat guides and equipment, begin product identification.
F. Per NFPA 472, take offensive actions on gasoline, diesel, natural gas, and propane and begin mitigation of hazard.
G. Determine if product is proceeding toward an area that will affect a larger area or population, i.e. waterway, storage drain, etc.
H. If called up to assist the Decontamination Team, you will follow the orders given by the Decontamination Operations Officer and Decontamination Team members.

VI. DECONTAMINATION TEAM RESPONSIBILITIES

A. Determine access to emergency and staging location with Incident Commander for the apparatus, keeping in mind elements such as wind, temperature, and topography.
B. Determine best location for Decontamination Reduction Corridor and establish corridor after consulting with Hazardous Materials Branch Director.

C. Set up appropriate Decontamination Reduction Corridor based on information received from Resources Technical Specialist and Incident Command.

D. Secure access to the corridor with barrier tape and police officers.

E. Dress the appropriate amount of Scrubbers and back-up Scrubbers for the incident and determine if additional resources are needed.

F. Establish a water supply for the Decontamination Team.

G. Establish a Safety Officer for the Decontamination Team.

H. Determine appropriate containment methods for the decontamination methods selected.

VII. DECONTAMINATION TEAM ASSIGNMENTS

Note: The primary objective when the Decontamination Team arrives on scene is to establish the Decontamination Reduction Corridor. This is the responsibility of the Decontamination Operation Officer, Engineers, and Senior Firefighters. Junior members will start to don appropriate PPE while this task is accomplished.

A. TR-09 Officer – Decontamination Group Supervisor

1. Report to Command Post.
2. Consult with Command Staff and determine location type and size of decontamination area and area for decontamination reduction corridor.
3. Request ALS for decontamination area for patient care, if necessary (i.e. vitals/accountability/patient transport).
4. Request Denver Police, if necessary, for securing decontamination area and civilian control.
5. Relay to Decontamination Operations Officer all pertinent information.
6. Acquire additional Denver Fire Department resources as requested by the Decontamination Operations Officer.

B. E-09 Officer – Decontamination Operations Officer
1. Supervise and direct the set up of decontamination operations and Decontamination Reduction Corridor.
2. Determine proper decontamination method and solution with information obtained from the Hazmat Technical Specialist.
3. Maintain a written record of incident on a Decontamination Officers Worksheet.
4. Notify Decontamination Group Supervisor when decontamination personnel and Decontamination Reduction Corridor are in place.
5. Monitor operations and determine if additional resources are needed.

C. TR-09 Engineer – Decontamination Safety/Medical Officer

1. Assist with set up of decontamination area and Reduction Corridor.
2. Assist Engine 9 Engineer in setting up water supply.
3. Assure with Decontamination Team Officer that the Decontamination Team members are appropriately suited and all medical and equipment records are recorded.
4. Maintain a written record on a Medical and Safety Officers Worksheet.
5. Observe operations with special consideration for safe operational practices.
6. Report any unsafe operations immediately to Decontamination Operations Officer, Decontamination Liaison Officer, or IC and stop operation, if necessary.
7. The Medical Officer is responsible for obtaining and recording baseline vital signs of Scrubbers and back-up team members, pre- and post-entry of the Scrubber, and monitoring and recording air levels, time inside the suits, and any other relevant information relating to the safety and health of the Scrubbers and back-up team members.

D. E-09 Engineer – Water Supply/Equipment Monitoring

1. Assist with set up of decontamination area and Reduction Corridor.
2. Establish water supply to Decontamination Reduction Corridor, which will include back-up line and water heating system.
3. Set up salamander heater to tents, if necessary.
4. Act as Valet for back-up Decontamination Team.
E. TR-09 Senior Firefighter

1. Drive the decontamination apparatus with E-09 senior firefighter to the scene and properly stage the vehicle as instructed by Incident Command.
2. Assist with set up of decontamination area and Reduction Corridor.
3. Don appropriate PPE and assume role of back-up Decontamination Team with E-09 senior firefighter.
4. If not involved in an active decontamination role, will assist with scrub stations and tool collections, and assume the role of group leader in large decontamination operations.

F. E-09 Senior Firefighter

1. Drive the decontamination apparatus with TR-09 senior firefighter to the scene and properly stage the vehicle as instructed by Incident Command.
2. Assist with set up of decontamination area and Reduction Corridor.
3. Don appropriate PPE and assume role of back-up Decontamination Team with TR-09 senior firefighter.
4. If not involved in an active decontamination role, will assist with scrub stations and tool collections, and assume the role of group leader in large decontamination operations.

G. TR-09 Junior Firefighter

1. Don appropriate PPE and assume role of Scrubber TR-09 junior firefighter.
2. Select and prepare any hazardous material monitors, meters, or product identification supplies that will be used in the Decontamination Reduction Corridor.

H. E-09 Junior Firefighter

1. Don appropriate PPE and assume role of Scrubber E-09 junior firefighter.
2. Select and prepare any hazardous material monitors, meters, or product identification supplies that will be used in the Decontamination Reduction Corridor.
Section C

2015 Colorado Commercial Driver License (CDL) Manual
Section 2
Driving Safely

This Section Covers

- Vehicle Inspection
- Basic Control of Your Vehicle
- Shifting Gears
- Seeing
- Communicating
- Space Management
- Controlling Your Speed
- Seeing Hazards
- Distracted Driving
- Aggressive Drivers/Road Rage
- Night Driving & Driver Fatigue
- Driving in Fog
- Winter Driving
- Hot Weather Driving
- Railroad-highway Crossings
- Mountain Driving
- Driving Emergencies
- Antilock Braking Systems
- Skid Control and Recovery
- Accident Procedures
- Fires
- Alcohol, Other Drugs, and Driving
- Hazardous Materials Rules

This section contains knowledge and safe driving information that all commercial drivers should know. You must pass a test on this information to get a CDL. This section does not have specific information on air brakes, combination vehicles, doubles, or passenger vehicles. When preparing for the Vehicle Inspection Test, you must review the material in Section 11 in addition to the information in this section. This section does have basic information on hazardous materials (HazMat) that all drivers should know. If you need a HazMat endorsement, you should study Section 9.

2.1 – Vehicle Inspection

2.1.1 – Why Inspect

Safety is the most important reason you inspect your vehicle, safety for yourself and for other road users. A vehicle defect found during an inspection could save you problems later. You could have a breakdown on the road that will cost time and dollars, or even worse, a crash caused by the defect.

Federal and state laws require that drivers inspect their vehicles. Federal and state inspectors also may inspect your vehicles. If they judge the vehicle to be unsafe, they will put it “out of service” until it is fixed.
2.1.2 – Types of Vehicle Inspection

Pre-trip Inspection. A Vehicle inspection will help you find problems that could cause a crash or breakdown.

During a Trip. For safety you should:

• Watch gauges for signs of trouble.
• Use your senses to check for problems (look, listen, smell, feel).
• Check critical items when you stop:
  • Tires, wheels and rims.
  • Brakes.
  • Lights and reflectors.
  • Brake and electrical connections to trailer. Trailer coupling devices.
  • Cargo securement devices.

Post-trip Inspection and Report. You should do an after-trip inspection at the end of the trip, day, or tour of duty on each vehicle you operated. It may include filling out a vehicle condition report listing any problems you find. The inspection report helps a motor carrier know when the vehicle needs repairs.

2.1.3 – What to Look For

Tire Problems

• Too much or too little air pressure.
• Bad wear. You need at least 4/32-inch tread depth in every major groove on front tires. You need 2/32 inch on other tires. No fabric should show through the tread or sidewall.
• Cuts or other damage. Tread separation.
• Dual tires that come in contact with each other or parts of the vehicle.
• Mismatched sizes.
• Radial and bias-ply tires used together. Cut or cracked valve stems.
• Re-grooved, recapped, or retreaded tires on the front wheels of a bus are prohibited.

Wheel and Rim Problems

• Damaged rims.
• Rust around wheel nuts may mean the nuts are loose–check tightness. After a tire has been changed, stop a short while later and re-check tightness of nuts.
• Missing clamps, spacers, studs, or lugs means danger.
• Mismatched, bent, or cracked lock rings are dangerous.
• Wheels or rims that have had welding repairs are not safe.

Bad Brake Drums or Shoes

• Cracked drums.
• Shoes or pads with oil, grease, or brake fluid on them.
• Shoes worn dangerously thin, missing, or broken.

Steering System Defects

• Missing nuts, bolts, cotter keys, or other parts. Bent, loose, or broken parts, such as steering column, steering gear box, or tie rods.
• If power steering equipped, check hoses, pumps, and fluid level; check for leaks.
• Steering wheel play of more than 10 degrees (approximately 2 inches movement at the rim of a 20-inch steering wheel) can make it hard to steer.

![Steering System Diagram](image-url)
Suspension System Defects
The suspension system holds up the vehicle and its load. It keeps the axles in place. Therefore, broken suspension parts can be extremely dangerous. Look for:

• Spring hangers that allow movement of axle from proper position. See Figure 2.2.

Key Suspension Parts

Figure 2.2

• Cracked or broken spring hangers.
• Missing or broken leaves in any leaf spring. If one-fourth or more are missing, it will put the vehicle “out of service”, but any defect could be dangerous. See Figure 2.3.

Safety Defect: Broken Leaf in Spring

Figure 2.3

• Broken leaves in a multi-leaf spring or leaves that have shifted so they might hit a tire or other part.
• Leaking shock absorbers.
• Torque rod or arm, u-bolts, spring hangers, or other axle positioning parts that are cracked, damaged, or missing.
• Air suspension systems that are damaged and/or leaking. See Figure 2.4.

Air Suspension Parts

Figure 2.4

• Any loose, cracked, broken, or missing frame members.

Exhaust System Defects. A broken exhaust system can let poison fumes into the cab or sleeper berth. Look for:

• Loose, broken, or missing exhaust pipes, mufflers, tailpipes, or vertical stacks.
• Loose, broken, or missing mounting brackets, clamps, bolts, or nuts.
• Exhaust system parts rubbing against fuel system parts, tires, or other moving parts of vehicle.
• Exhaust system parts that are leaking.

Emergency Equipment. Vehicles must be equipped with emergency equipment. Look for:

• Fire extinguisher(s).
• Spare electrical fuses (unless equipped with circuit breakers).
• Warning devices for parked vehicles (for example, three reflective warning triangles or 6 fusees or 3 liquid burning flares).

Cargo (Trucks). You must make sure the truck is not overloaded and the cargo is balanced and secured before each trip. If the cargo contains hazardous materials, you must inspect for proper papers and placarding.
2.1.4 – CDL Vehicle Inspection Test

In order to obtain a CDL you will be required to pass a Vehicle inspection test. You will be tested to see if you know whether your vehicle is safe to drive. You will be asked to do a Vehicle inspection of your vehicle and explain to the examiner what you would inspect and how. The following seven-step inspection method should be useful.

2.1.5 – Seven-step Inspection Method

Method of Inspection. You should do a Vehicle inspection the same way each time so you will learn all the steps and be less likely to forget something.

Review Last Vehicle Inspection Report. Drivers may have to make a vehicle inspection report in writing each day. The motor carrier must repair any items in the report that affect safety and certify on the report that repairs were made or were unnecessary. You must sign the report only if defects were noted and certified to be repaired or not needed to be repaired.

Vehicle Inspection Guide

• Step 1: Vehicle Overview
  Approaching the Vehicle. Notice general condition. Look for damage or vehicle leaning to one side. Look under the vehicle for fresh oil, coolant, grease, or fuel leaks. Check the area around the vehicle for hazards to vehicle movement (people, other vehicles, objects, low-hanging wires, limbs, etc.).

• Step 2: Check Engine Compartment
  Check That the Parking Brakes Are On and/or Wheels Chocked.
  You may have to raise the hood, tilt the cab (secure loose things so they don’t fall and break something), or open the engine compartment door.
  • Check the following: Engine oil level.
  • Coolant level in radiator; condition of hoses.
  • Power steering fluid level; hose condition (if so equipped).
  • Windshield washer fluid level.
  • Battery connections and tie downs (battery may be located elsewhere)
  • Automatic transmission fluid level (may require engine to be running).
  • Check belts for tightness and excessive wear (alternator, water pump, air compressor).
  • Leaks in the engine compartment (fuel, coolant, oil, power steering fluid, hydraulic fluid, battery fluid).
  • Cracked, worn electrical wiring insulation.
  Lower and secure hood, cab, or engine compartment door.

• Step 3: Start Engine and Inspect Inside the Cab
  Get In and Start Engine
  • Make sure parking brake is on.
  • Put gearshift in neutral (or “park” if automatic).
  • With the clutch in start engine; listen for unusual noises. If equipped, check the Anti-lock Braking System (ABS) indicator lights. Light on dash should come on and then turn off.

Look at the Gauges
  • Oil pressure. Should come up to normal within seconds after engine is started. See Figure 2.5
  • Air pressure. Pressure should build from 85psi to100 psi within 45 seconds. Build air pressure to governor cut-out (usually around 120 – 140 psi.
  • Ammeter and/or voltmeter. Should be in normal range(s).
  • Coolant temperature. Should begin gradual rise to normal operating range.
  • Engine oil temperature. Should begin gradual rise to normal operating range.
  • Warning lights and buzzers. Oil, coolant, charging circuit warning, and antilock brake system lights should go out right away.

![Oil Pressure](image)

**Oil Pressure**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idling</td>
<td>5-20 PSI</td>
</tr>
<tr>
<td>Operating</td>
<td>35-75 PSI</td>
</tr>
<tr>
<td>Low, Dropping,</td>
<td>STOP IMMEDIATELY!</td>
</tr>
<tr>
<td>Fluctuating:</td>
<td>Without oil, the engine can be destroyed rapidly.</td>
</tr>
</tbody>
</table>

Figure 2.5
Check Condition of Controls. Check all of the following for looseness, sticking, damage, or improper setting:

- Steering wheel. Clutch.
- Accelerator ("gas pedal").
- Brake controls.
- Foot brake.
- Trailer brake (if vehicle has one).
- Parking brake.
- Retarder controls (if vehicle has them).
- Transmission controls.
- Interaxle differential lock (if vehicle has one).
- Horn(s).
- Windshield wiper/washer.
- Lights.
- Headlights.
- Dimmer switch.
- Turn signal.
- Four-way flashers.
- Parking, clearance, identification, marker switch(es).

Check Mirrors and Windshield. Inspect mirrors and windshield for cracks, dirt, illegal stickers, or other obstructions to seeing clearly. Clean and adjust as necessary.

Check Emergency Equipment

Check for safety equipment:

- Spare electrical fuses (unless vehicle has circuit breakers).
- Three red reflective triangles, 6 fuses or 3 liquid burning flares.
- Properly charged and rated fire extinguisher.
- Safety Belt is not frayed or ripped and latches.

Check for optional items such as:

- Chains (where winter conditions require).
- Tire changing equipment.
- List of emergency phone numbers.
- Accident reporting kit (packet).

Air Brake Check.

Perform the Four (4) parts of the Air Brake check as part of the In-Cab Inspection.

Reference: Section 6, Section 11

Step 4: Turn Off Engine and Check Lights

Make sure the parking brake is set, turn off the engine, and take the key with you.

- Turn on headlights (low beams) and four-way emergency flashers, and get out of the vehicle and check if they are working.
- Go to front of vehicle and check that low beams are on and both of the four-way flashers are working.
- Push dimmer switch and check that high beams work.
- Turn off headlights and four-way emergency flashers.
- Turn on parking, clearance, side-marker, and identification lights.
- Turn on right turn signal.
- Turn on left turn signal:
  - Parking, clearance, and identification lights are clean, and proper color (amber at front).
  - Reflectors are clean and proper color (amber at front).

Step 5: Do Walk-around Inspection

Left Front Side

- Driver’s door glass should be clean.
- Door latches or locks should work properly.
- Left front wheel:
  - Condition of rim.
  - Condition of tire.
  - Tight lug nuts.
  - Hub oil level is between the add and full mark, no leaks.
- Left front suspension:
  - Condition of springs, spring hangers, shackles, u-bolts.
  - Condition of shock absorber.
  - Condition of front axle.
  - Condition of steering system.
- Left front brake:
  - Condition of brake drum or disc.
  - Condition of brake linings or pads
  - Condition of hoses.
- Primary and secondary safety cab locks engaged (if cab-over-engine design).
- Fuel tank(s).
- Spare tire.

- Condition of visible parts:
  - Rear of engine.
  - Transmission.
  - Exhaust system.
  - Frame and cross members.
  - Drive Shaft.
  - Air lines and electrical wiring.
  - Header board.
  - Tie downs.
  - Canvas or tarp.
  - Cargo compartment doors.
Left Rear Side

• Left rear wheels:
  • Condition of rims.
  • Condition of tires.
  • Condition of spacers.
  • Tight lug nuts.
  • Wheel bearing/seals.
• Suspension:
  • Condition of spring(s), spring hangers, shackles, and u-bolts.
  • Axle secure.
  • Powered axle(s) not leaking lube (gear oil).
  • Condition of torque rod arms, bushings.
  • Condition of shock absorber(s).
  • If retractable axle equipped, check condition of lift mechanism. If air powered, check for leaks.
  • Condition of air ride components.
• Brakes:
  • Condition of brake drum or disc.
  • Condition of brake linings or pads.
  • Condition of hoses.
• Lights and reflectors:
  • Side-marker lights clean and proper color (red at rear, others amber).
  • Side-marker reflectors clean and proper color (red at rear, others amber).

Rear

• Lights and reflectors:
  • Rear clearance and identification lights clean, and proper color (red at rear).
  • Reflectors clean and proper color (red at rear).
  • Taillights clean and proper color (red at rear).
  • Right and left rear turns are the proper color (red, yellow, or amber at rear).
• License plate(s).
• Splash guards.
• Tailboards up and properly secured.
• End gates free of damage, properly secured in stake sockets.
• Rear doors securely closed, latched/locked.

Right Side

• Check all items as done on left side.

• Step 6: Check Signal Lights
  • Turn on headlights and four-way emergency flashers, and get out of the vehicle and check if they are working.
  • Go to rear of vehicle and check that tail lights are on and both of the four-way flashers are working.
  • Turn off rear of vehicle and check that tail lights are on and both of the four-way flashers are working.
  • Turn on headlights and four-way emergency flashers.
  • Turn on parking, clearance, side-marker, and identification lights.
  • Turn on right turn signal.
  • Turn on left turn signal

• Step 7: Start the Engine and Check Braking System
  • Test for air leaks on air brake equipped vehicles.
  • Test for hydraulic leaks on none air brake vehicles.
  • Test parking brake.
  • Test service brake stopping action.

If you find anything unsafe during the pre-trip inspection, get it fixed. Federal and state laws forbid operating an unsafe vehicle.

Inspection During a Trip

Check Vehicle Operation Regularly

You should check:

• Instruments.
• Air pressure gauge(s) (if you have air brakes).
• Temperature gauge.
• Pressure gauge.
• Ammeter/voltmeter.
• Mirrors.
• Tires.
• Cargo, cargo covers.

If you see, hear, smell, or feel anything that might mean trouble, check it out.

Safety Inspection. Drivers of CMVs that are transporting cargo must inspect the cargo within the first 50 miles of a trip and every 150 miles or every three hours (whichever comes first) to ensure it is secured.

After-Trip Inspection and Report

You may have to make a written report each day on the condition of the vehicle(s), you drove. Report anything affecting safety or possibly leading to mechanical breakdown front.
Subsection 2.1

Test Your Knowledge

1. What is the most important reason for doing a vehicle inspection?
2. What things should you check during a trip?
3. Name some key steering system parts.
4. Name some suspension system defects.
5. What three kinds of emergency equipment must you have?
6. What is the minimum tread depth for front tires? For other tires?
7. Name some things you should check on the front of your vehicle during the walk around inspection.
8. What should wheel bearing seals be checked for?
9. How many red reflective triangles should you carry?
10. How do you test hydraulic brakes for leaks?
11. Why put the starter switch key in your pocket during the Vehicle inspection?

2.2 – Basic Control of Your Vehicle

To drive a vehicle safely, you must be able to control its speed and direction. Safe operation of a commercial vehicle requires skill in:

- Accelerating.
- Steering.
- Stopping.
- Backing safely.

Fasten your seatbelt when on the road. Apply the parking brake when you leave your vehicle.

2.2.1 – Accelerating

Don’t roll back when you start. You may hit someone behind you. If you have a manual transmission vehicle, partly engage the clutch before you take your right foot off the brake. Put on the parking brake whenever necessary to keep from rolling back. Release the parking brake only when you have applied enough engine power to keep from rolling back. On a tractor-trailer equipped with a trailer brake hand valve, the hand valve can be applied to keep from rolling back.

Speed up smoothly and gradually so the vehicle does not jerk. Rough acceleration can cause mechanical damage. When pulling a trailer, rough acceleration can damage the coupling. Speed up very gradually when traction is poor, as in rain or snow. If you use too much power, the drive wheels may spin. You could lose control. If the drive wheels begin to spin, take your foot off the accelerator.

2.2.2 – Steering

Hold the steering wheel firmly with both hands. Your hands should be on opposite sides of the wheel. If you hit a curb or a pothole (chuckhole), the wheel could pull away from your hands unless you have a firm hold.

2.2.3 – Stopping

Push the brake pedal down gradually. The amount of brake pressure you need to stop the vehicle will depend on the speed of the vehicle and how quickly you need to stop. Control the pressure so the vehicle comes to a smooth, safe stop. If you have a manual transmission, push the clutch in when the engine is close to idle.
2.2.4 – Backing Safely
Because you cannot see everything behind your vehicle, backing is always dangerous. Avoid backing whenever you can. When you park, try to park so you will be able to pull forward when you leave. When you have to back, here are a few simple safety rules:

• Start in the proper position. Look at your path.
• Use mirrors on both sides. Back slowly.
• Back and turn toward the driver’s side whenever possible.
• Use a helper whenever possible.

These rules are discussed in turn below:

Start in the Proper Position. Put the vehicle in the best position to allow you to back safely. This position will depend on the type of backing to be done.

Look at Your Path. Look at your line of travel before you begin. Get out and walk around the vehicle. Check your clearance to the sides and overhead, in and near the path your vehicle will take.

Use Mirrors on Both Sides. Check the outside mirrors on both sides frequently. Get out of the vehicle and check your path if you are unsure.

Back Slowly. Always back as slowly as possible. Use the lowest reverse gear. That way you can more easily correct any steering errors. You also can stop quickly if necessary.

Back and Turn Toward the Driver’s Side. Back to the driver’s side so that you can see better. Backing toward the right side is very dangerous because you can’t see as well. If you back and turn toward the driver’s side, you can watch the rear of your vehicle by looking out the side window. Use driver-side backing—even if it means going around the block to put your vehicle in this position. The added safety is worth it.

Use a Helper. Use a helper when you can. There are blind spots you can’t see. That’s why a helper is important. The helper should stand near the back of your vehicle where you can see the helper. Before you begin backing, work out a set of hand signals that you both understand. Agree on a signal for “stop.”

2.3 – Shifting Gears
Correct shifting of gears is important. If you can’t get your vehicle into the right gear while driving, you will have less control.

2.3.1 – Manual Transmissions
Basic Method for Shifting Up. Most heavy vehicles with manual transmissions require double clutching to change gears. This is the basic method:

Release accelerator, push in clutch and shift to neutral at the same time.

Release clutch.

Let engine and gears slow down to the rpm required for the next gear (this takes practice).

Push in clutch and shift to the higher gear at the same time.

Release clutch and press accelerator at the same time.

Shifting gears using double clutching requires practice. If you remain too long in neutral, you may have difficulty putting the vehicle into the next gear. If so, don’t try to force it. Return to neutral, release clutch, increase engine speed to match road speed, and try again.

Knowing When to Shift Up. There are two ways of knowing when to shift:

Use Engine Speed (rpm). Study the driver’s manual for your vehicle and learn the operating rpm range. Watch your tachometer, and shift up when your engine reaches the top of the range. (Some newer vehicles use “progressive” shifting: the rpm at which you shift becomes higher as you move up in the gears. Find out what’s right for the vehicle you will operate.)

Use Road Speed (mph). Learn what speeds each gear is good for. Then, by using the speedometer, you’ll know when to shift up.

With either method, you may learn to use engine sounds to know when to shift.

Basic Procedures for Shifting Down
Release accelerator, push in clutch, and shift to neutral at the same time.

Release clutch.

Press accelerator, increase engine and gear speed to the rpm required in the lower gear.

Push in clutch and shift to lower gear at the same time.

Release clutch and press accelerator at the same time.

Downshifting, like upshifting, requires knowing when to shift. Use either the tachometer or the speedometer and downshift at the right rpm or road speed.
Special conditions where you should downshift are:

Before Starting Down a Hill. Slow down and shift down to a speed that you can control without using the brakes hard. Otherwise the brakes can overheat and lose their braking power.

Downshift before starting down the hill. Make sure you are in a low enough gear, usually lower than the gear required to climb the same hill.

Before Entering a Curve. Slow down to a safe speed, and downshift to the right gear before entering the curve. This lets you use some power through the curve to help the vehicle be more stable while turning. It also allows you to speed up as soon as you are out of the curve.

2.3.2 – Multi-speed Rear Axles and Auxiliary Transmissions

Multi-speed rear axles and auxiliary transmissions are used on many vehicles to provide extra gears. You usually control them by a selector knob or switch on the gearshift lever of the main transmission. There are many different shift patterns. Learn the right way to shift gears in the vehicle you will drive.

2.3.3 – Automatic Transmissions

Some vehicles have automatic transmissions. You can select a low range to get greater engine braking when going down grades. The lower ranges prevent the transmission from shifting up beyond the selected gear (unless the governor rpm is exceeded). It is very important to use this braking effect when going down grades.

2.3.4 – Retarders

Some vehicles have “retarders.” Retarders help slow a vehicle, reducing the need for using your brakes. They reduce brake wear and give you another way to slow down. There are four basic types of retarders (exhaust, engine, hydraulic, and electric). All retarders can be turned on or off by the driver. On some vehicles the retarding power can be adjusted. When turned “on,” retarders apply their braking power (to the drive wheels only) whenever you let up on the accelerator pedal all the way.

Because these devices can be noisy, be sure you know where their use is permitted.

Caution. When your drive wheels have poor traction, the retarder may cause them to skid. Therefore, you should turn the retarder off whenever the road is wet, icy, or snow covered.

Subsections 2.2 and 2.3

Test Your Knowledge

1. Why should you back toward the driver’s side?
2. If stopped on a hill, how can you start moving without rolling back?
3. When backing, why is it important to use a helper?
4. What’s the most important hand signal that you and the helper should agree on?
5. What are the two special conditions where you should downshift?
6. When should you downshift automatic transmissions?
7. Retarders keep you from skidding when the road is slippery. True or False?
8. What are the two ways to know when to shift?

These questions may be on the test. If you can’t answer them all, re-read subsections 2.2 and 2.3.
2.4 – Seeing

To be a safe driver you need to know what’s going on all around your vehicle. Not looking properly is a major cause of accidents.

2.4.1 – Seeing Ahead

All drivers look ahead; but many don’t look far enough ahead.

**Importance of Looking Far Enough Ahead.** Because stopping or changing lanes can take a lot of distance, knowing what the traffic is doing on all sides of you is very important. You need to look well ahead to make sure you have room to make these moves safely.

**How Far Ahead to Look.** Most good drivers look at least 12 to 15 seconds ahead. That means looking ahead the distance you will travel in 12 to 15 seconds. At lower speeds, that’s about one block. At highway speeds it’s about a quarter of a mile. If you’re not looking that far ahead, you may have to stop too quickly or make quick lane changes.

Looking 12 to 15 seconds ahead doesn’t mean not paying attention to things that are closer. Good drivers shift their attention back and forth, near and far. Figure 2.6 illustrates how far to look ahead.

**City Driving**

12-15 Seconds is About One Block

**Open Highway**

12-15 Seconds is About a Quarter-Mile

*Figure 2.6*

**Look for Traffic.** Look for vehicles coming onto the highway, into your lane, or turning. Watch for brake lights from slowing vehicles. By seeing these things far enough ahead, you can change your speed, or change lanes if necessary to avoid a problem. If a traffic light has been green for a long time it will probably change before you get there. Start slowing down and be ready to stop.

2.4.2 – Seeing to the Sides and Rear

It’s important to know what’s going on behind and to the sides. Check your mirrors regularly. Check more often in special situations.

**Mirror Adjustment.** Mirror adjustment should be checked prior to the start of any trip and can only be checked accurately when the trailer(s) are straight. You should check and adjust each mirror to show some part of the other vehicle. This will give you a reference point for judging the position of the other images.

**Regular Checks.** You need to make regular checks of your mirrors to be aware of traffic and to check your vehicle.

**Traffic.** Check your mirrors for vehicles on either side and in back of you. In an emergency, you may need to know whether you can make a quick lane change. Use your mirrors to spot overtaking vehicles. There are “blind spots” that your mirrors cannot show you. Check your mirrors regularly to know where other vehicles are around you, and to see if they move into your blind spots.

**Check Your Vehicle.** Use the mirrors to keep an eye on your tires. It’s one way to spot a tire fire. If you’re carrying open cargo, you can use the mirrors to check it. Look for loose straps, ropes, or chains. Watch for a flapping or ballooning tarp.

**Special Situations.** Special situations require more than regular mirror checks. These are lane changes, turns, merges, and tight maneuvers.

**Lane Changes.** You need to check your mirrors to make sure no one is alongside you or about to pass you. Check your mirrors:

- Before you change lanes to make sure there is enough room.
- After you have signaled, to check that no one has moved into your blind spot.
- Right after you start the lane change, to double-check that your path is clear.
- After you complete the lane change.

**Turns.** In turns, check your mirrors to make sure the rear of your vehicle will not hit anything.

**Merges.** When merging, use your mirrors to make sure the gap in traffic is large enough for you to enter safely.

**Tight Maneuvers.** Any time you are driving in close quarters, check your mirrors often. Make sure you have enough clearance.

**How to Use Mirrors.** Use mirrors correctly by checking them quickly and understanding what you see.

When you use your mirrors while driving on the road, check quickly. Look back and forth between the mirrors and the road ahead. Don’t focus on the mirrors for too long. Otherwise, you will travel quite a distance without knowing what’s happening ahead.

Many large vehicles have curved (convex, “fisheye,” “spot,” "bug-eye") mirrors that show a wider area than flat mirrors. This is often helpful. But everything appears smaller in a convex mirror than it would if you were looking at it directly. Things also seem farther away than they really are. It’s important to realize this and to allow for it. Figure 2.7 shows the field of vision using a convex mirror.
2.5 – Communicating

2.5.1 – Signal Your Intentions

Other drivers can’t know what you are going to do until you tell them.

Signaling what you intend to do is important for safety. Here are some general rules for signaling.

**Field of Vision Using a Convex Mirror**

- **Driver**
- **Convex Mirror View**
- **Plane Mirror View**
- **Blind Spot Area**

![Figure 2.7](image)

**Turns.** There are three good rules for using turn signals:

- **Signal early.** Signal well before you turn. It is the best way to keep others from trying to pass you.

- **Signal continuously.** You need both hands on the wheel to turn safely. Don’t cancel the signal until you have completed the turn.

- **Cancel your signal.** Don’t forget to turn off your turn signal after you’ve turned (if you don’t have self-canceling signals).

**Lane Changes.** Put your turn signal on before changing lanes. Change lanes slowly and smoothly. That way a driver you didn’t see may have a chance to honk his/her horn, or avoid your vehicle.

**Slowing Down.** Warn drivers behind you when you see you’ll need to slow down. A few light taps on the brake pedal -- enough to flash the brake lights -- should warn following drivers. Use the four-way emergency flashers for times when you are driving very slowly or are stopped. Warn other drivers in any of the following situations:

- **Trouble Ahead.** The size of your vehicle may make it hard for drivers behind you to see hazards ahead. If you see a hazard that will require slowing down, warn the drivers behind by flashing your brake lights.

- **Tight Turns.** Most car drivers don’t know how slowly you have to go to make a tight turn in a large vehicle. Give drivers behind you warning by braking early and slowing gradually.

- **Stopping on the Road.** Truck and bus drivers sometimes stop in the roadway to unload cargo or passengers, or to stop at a railroad crossing. Warn following drivers by flashing your brake lights. Don’t stop suddenly.

- **Driving Slowly.** Drivers often do not realize how fast they are catching up to a slow vehicle until they are very close. If you must drive slowly, alert following drivers by turning on your emergency flashers if it is legal. (Laws regarding the use of flashers differ from one state to another. Check the laws of the states where you will drive.)

- **Don’t Direct Traffic.** Some drivers try to help out others by signaling when it is safe to pass. You should not do this. You could cause an accident. You could be blamed and it could cost you many thousands of dollars.
2.5.2 – Communicating Your Presence

Other drivers may not notice your vehicle even when it’s in plain sight. To help prevent accidents, let them know you’re there.

When Passing. Whenever you are about to pass a vehicle, pedestrian, or bicyclist, assume they don’t see you. They could suddenly move in front of you. When it is legal, tap the horn lightly or, at night, flash your lights from low to high beam and back. And, drive carefully enough to avoid a crash even if they don’t see or hear you.

When It’s Hard to See. At dawn, dusk, in rain, or snow, you need to make yourself easier to see. If you are having trouble seeing other vehicles, other drivers will have trouble seeing you. Turn on your lights. Use the headlights, not just the identification or clearance lights. Use the low beams; high beams can bother people in the daytime as well as at night.

When Parked at the Side of the Road. When you pull off the road and stop, be sure to turn on the four-way emergency flashers. This is important at night. If you stop on a two-lane road carrying traffic in both directions or on an undivided highway, place warning devices within 10 feet of the front or rear corners to mark the location of the vehicle and 100 feet behind and ahead of the vehicle, on the shoulder or in the lane you stopped in. See Figure 2.9.

Two-Way or Undivided Highway

Back beyond any hill, curve, or other obstruction that prevents other drivers from seeing the vehicle within 500 feet. If line of sight view is obstructed due to hill or curve, move the rear-most triangle to a point back down the road so warning is provided. See Figure 2.10.

Use Your Horn When Needed. Your horn can let others know you’re there. It can help to avoid a crash. Use your horn when needed. However, it can startle others and could be dangerous when used unnecessarily.
2.6 – Controlling Speed

Driving too fast is a major cause of fatal crashes. You must adjust your speed depending on driving conditions. These include traction, curves, visibility, traffic and hills.

2.6.1 – Stopping Distance

Perception Distance + Reaction Distance + Braking Distance = Total Stopping Distance

Perception distance. The distance your vehicle travels, in ideal conditions; from the time you see a hazard until your brain recognizes it. Keep in mind certain mental and physical conditions can affect your perception distance. It can be affected greatly depending on visibility and the hazard itself. The average perception time for an alert driver is 1\(\frac{1}{4}\) seconds. At 55 mph this accounts for 142 feet traveled.

Reaction distance. The distance you will continue to travel, in ideal conditions; before you physically hit the brakes, in response to a hazard seen ahead. The average driver has a reaction time of \(\frac{3}{4}\) second to 1 second. At 55 mph this accounts for 61 feet traveled.

Braking distance. The distance your vehicle will travel, in ideal conditions; while you are braking. At 55 mph on dry pavement with good brakes, it can take about 216 feet.

Total stopping distance. The total minimum distance your vehicle has traveled, in ideal conditions; with everything considered, including perception distance, reaction distance and braking distance, until you can bring your vehicle to a complete stop. At 55 mph, your vehicle will travel a minimum of 419 feet. See Figure 2.11.

The Effect of Speed on Stopping Distance.

The faster you drive, the greater the impact or striking power of your vehicle. When you double your speed from 20 to 40 mph the impact is 4 times greater. The braking distance is also 4 times longer. Triple the speed from 20 to 60 mph and the impact and braking distance is 9 times greater. At 60 mph, your stopping distance is greater than the length of a football field. Increase the speed to 80 mph and the impact and braking distance are 16 times greater than at 20 mph. High speeds greatly increase the severity of crashes and stopping distances. By slowing down, you can reduce braking distance.

The Effect of Vehicle Weight on Stopping Distance. The heavier the vehicle, the more work the brakes must do to stop it, and the more heat they absorb. But the brakes, tires, springs, and shock absorbers on heavy vehicles are designed to work best when the vehicle is fully loaded. Empty trucks require greater stopping distances because an empty vehicle has less traction.

2.6.2 – Matching Speed to the Road Surface

You can’t steer or brake a vehicle unless you have traction. Traction is friction between the tires and the road. There are some road conditions that reduce traction and call for lower speeds.

Slippery Surfaces. It will take longer to stop, and it will be harder to turn without skidding, when the road is slippery. Wet roads can double stopping distance. You must drive slower to be able to stop in the same distance as on a dry road. Reduce speed by about one-third (e.g., slow from 55 to about 35 mph) on a wet road. On packed snow, reduce speed by a half, or more. If the surface is icy, reduce speed to a crawl and stop driving as soon as you can safely do so.

Identifying Slippery Surfaces. Sometimes it’s hard to know if the road is slippery. Here are some signs of slippery roads:

- Shaded Areas. Shady parts of the road will remain icy and slippery long after open areas have melted.
- Bridges. When the temperature drops, bridges will freeze before the road will. Be especially careful when the temperature is close to 32 degrees Fahrenheit.
- Melting Ice. Slight melting will make ice wet. Wet ice is much more slippery than ice that is not wet.
- Black Ice. Black ice is a thin layer that is clear enough that you can see the road underneath it. It makes the road look wet. Any time the temperature is below freezing and the road looks wet, watch out for black ice.
- Vehicle Icing. An easy way to check for ice is to open the window and feel the front of the mirror, mirror support, or antenna. If there’s ice on these, the road surface is probably starting to ice up.
- Just After Rain Begins. Right after it starts to rain, the water mixes with oil left on the road by vehicles. This makes the road very slippery. If the rain continues, it will wash the oil away.
Hydroplaning. In some weather, water or slush collects on the road. When this happens, your vehicle can hydroplane. It’s like water skiing--the tires lose their contact with the road and have little or no traction. You may not be able to steer or brake. You can regain control by releasing the accelerator and pushing in the clutch. This will slow your vehicle and let the wheels turn freely. If the vehicle is hydroplaning, do not use the brakes to slow down.

If the drive wheels start to skid, push in the clutch to let them turn freely.

It does not take a lot of water to cause hydroplaning. Hydroplaning can occur at speeds as low as 30 mph if there is a lot of water. Hydroplaning is more likely if tire pressure is low, or the tread is worn. (The grooves in a tire carry away the water; if they aren’t deep, they don’t work well.)

Road surfaces where water can collect can create conditions that cause a vehicle to hydroplane. Watch for clear reflections, tire splashes, and raindrops on the road. These are indications of standing water.

2.6.3 – Speed and Curves

Drivers must adjust their speed for curves in the road. If you take a curve too fast, two things can happen. The tires can lose their traction and continue straight ahead, so you skid off the road. Or, the tires may keep their traction and the vehicle rolls over. Tests have shown that trucks with a high center of gravity can roll over at the posted speed limit for a curve.

Slow to a safe speed before you enter a curve. Braking in a curve is dangerous because it is easier to lock the wheels and cause a skid. Slow down as needed. Don’t ever exceed the posted speed limit for the curve. Be in a gear that will let you accelerate slightly in the curve. This will help you keep control.

2.6.4 – Speed and Distance Ahead

You should always be able to stop within the distance you can see ahead. Fog, rain, or other conditions may require that you slowdown to be able to stop in the distance you can see. At night, you can’t see as far with low beams as you can with high beams. When you must use low beams, slow down.

2.6.5 – Speed and Traffic Flow

When you’re driving in heavy traffic, the safest speed is the speed of other vehicles. Vehicles going the same direction at the same speed are not likely to run into one another. In many locations, speed limits are lower for trucks and buses than for cars. It can vary as much as 15 mph. Use extra caution when you change lanes or pass on these roadways. Drive at the speed of the traffic, if you can without going at an illegal or unsafe speed. Keep a safe following distance.

The main reason drivers exceed speed limits is to save time. But, anyone trying to drive faster than the speed of traffic will not be able to save much time. The risks involved are not worth it. If you go faster than the speed of other traffic, you’ll have to keep passing other vehicles. This increases the chance of a crash, and it is more tiring. Fatigue increases the chance of a crash. Going with the flow of traffic is safer and easier.

2.6.6 – Speed on Downgrades

Your vehicle’s speed will increase on downgrades because of gravity. Your most important objective is to select and maintain a speed that is not too fast for the:

- Total weight of the vehicle and cargo.
- Length of the grade.
- Steepness of the grade.
- Road conditions.
- Weather.

If a speed limit is posted, or there is a sign indicating “Maximum Safe Speed,” never exceed the speed shown. Also, look for and heed warning signs indicating the length and steepness of the grade. You must use the braking effect of the engine as the principal way of controlling your speed on downgrades. The braking effect of the engine is greatest when it is near the governed rpms and the transmission is in the lower gears. Save your brakes so you will be able to slow or stop as required by road and traffic conditions. Shift your transmission to a low gear before starting down the grade and use the proper braking techniques. Please read carefully the section on going down long, steep downgrades safely in “Mountain Driving.”

2.6.7 – Roadway Work Zones

Speeding traffic is the number one cause of injury and death in roadway work zones. Observe the posted speed limits at all times when approaching and driving through a work zone. Watch your speedometer, and don’t allow your speed to creep up as you drive through long sections of road construction. Decrease your speed for adverse weather or road conditions. Decrease your speed even further when a worker is close to the roadway.
Subsections 2.4, 2.5, and 2.6

Test Your Knowledge
1. How far ahead does the manual say you should look?
2. What are two main things to look for ahead?
3. What’s your most important way to see the sides and rear of your vehicle?
4. What does “communicating” mean in safe driving?
5. Where should you place reflectors when stopped on a divided highway?
6. What three things add up to total stopping distance?
7. If you go twice as fast, will your stopping distance increase by two or four times?
8. Empty trucks have the best braking. True or False?
9. What is hydroplaning?
10. What is “black ice”?

These questions may be on the test. If you can’t answer them all, re-read subsections 2.4, 2.5, and 2.6.

2.7 – Managing Space

To be a safe driver, you need space all around your vehicle. When things go wrong, space gives you time to think and to take action.

To have space available when something goes wrong, you need to manage space. While this is true for all drivers, it is very important for large vehicles. They take up more space and they require more space for stopping and turning.

2.7.1 – Space Ahead

Of all the space around your vehicle, it is the area ahead of the vehicle – the space you’re driving into – that is most important.

The Need for Space Ahead. You need space ahead in case you must suddenly stop. According to accident reports, the vehicle that trucks and buses most often run into is the one in front of them. The most frequent cause is following too closely. Remember, if the vehicle ahead of you is smaller than yours, it can probably stop faster than you can. You may crash if you are following too closely.

How Much Space? How much space should you keep in front of you? One good rule says you need at least one second for each 10 feet of vehicle length at speeds below 40 mph. At greater speeds, you must add 1 second for safety. For example, if you are driving a 40-foot vehicle, you should leave 4 seconds between you and the vehicle ahead. In a 60-foot rig, you’ll need 6 seconds. Over 40 mph, you’d need 5 seconds for a 40-foot vehicle and 7 seconds for a 60-foot vehicle. See Figure 2.12.

Heavy Vehicle Formula

For timed interval following distance
- 1 second required for each 10 feet of vehicle length at speeds under 40 MPH
- Above 40 MPH use same formula, then add 1 second for the additional speed

40 foot truck (under 40 MPH) = 4 seconds
50 foot truck (above 40 MPH) = 6 seconds
60 foot truck (under 40 MPH) = 6 seconds

Figure 2.12
To know how much space you have, wait until the vehicle ahead passes a shadow on the road, a pavement marking, or some other clear landmark. Then count off the seconds like this: "one thousand-and-one, one thousand-and-two" and so on, until you reach the same spot. Compare your count with the rule of one second for every ten feet of length.

If you are driving a 40-foot truck and only counted up to 2 seconds, you’re too close. Drop back a little and count again until you have 4 seconds of following distance (or 5 seconds, if you’re going over 40 mph). After a little practice, you will know how far back you should be. Remember to add 1 second for speeds above 40 mph. Also remember that when the road is slippery, you need much more space to stop.

2.7.2 – Space Behind
You can’t stop others from following you too closely. But there are things you can do to make it safer.

Stay to the Right. Heavy vehicles are often tailgated when they can’t keep up with the speed of traffic. This often happens when you’re going uphill. If a heavy load is slowing you down, stay in the right lane if you can. Going uphill, you should not pass another slow vehicle unless you can get around quickly and safely.

Dealing with Tailgaters Safely. In a large vehicle, it’s often hard to see whether a vehicle is close behind you. You may be tailgated:

When you are traveling slowly. Drivers trapped behind slow vehicles often follow closely.

In bad weather. Many car drivers follow large vehicles closely during bad weather, especially when it is hard to see the road ahead.

If you find yourself being tailgated, here are some things you can do to reduce the chances of a crash:

Avoid quick changes. If you have to slow down or turn, signal early, and reduce speed very gradually.

Increase your following distance. Opening up room in front of you will help you to avoid having to make sudden speed or direction changes. It also makes it easier for the tailgater to get around you.

Don’t speed up. It’s safer to be tailgated at a low speed than a high speed.

Avoid tricks. Don’t turn on your taillights or flash your brake lights. Follow the suggestions above.

2.7.3 – Space to the Sides
Commercial vehicles are often wide and take up most of a lane. Safe drivers will manage what little space they have. You can do this by keeping your vehicle centered in your lane, and avoid driving alongside others.

Staying Centered in a Lane. You need to keep your vehicle centered in the lane to keep safe clearance on either side. If your vehicle is wide, you have little room to spare.

Traveling Next to Others. There are two dangers in traveling alongside other vehicles:

Another driver may change lanes suddenly and turn into you.

You may be trapped when you need to change lanes.

Find an open spot where you aren’t near other traffic. When traffic is heavy, it may be hard to find an open spot. If you must travel near other vehicles, try to keep as much space as possible between you and them. Also, drop back or pull forward so that you are sure the other driver can see you.

Strong Winds. Strong winds make it difficult to stay in your lane. The problem is usually worse for lighter vehicles. This problem can be especially bad coming out of tunnels. Don’t drive alongside others if you can avoid it.

2.7.4 – Space Overhead
Hitting overhead objects is a danger. Make sure you always have overhead clearance.

Don’t assume that the heights posted at bridges and overpasses are correct. Re-paving or packed snow may have reduced the clearances since the heights were posted.

The weight of a cargo van changes its height. An empty van is higher than a loaded one. That you got under a bridge when you were loaded does not mean that you can do it when you are empty.

If you doubt you have safe space to pass under an object, go slowly. If you aren’t sure you can make it, take another route. Warnings are often posted on low bridges or underpasses, but sometimes they are not.

Some roads can cause a vehicle to tilt. There can be a problem clearing objects along the edge of the road, such as signs, trees, or bridge supports. Where this is a problem, drive a little closer to the center of the road.

Before you back into an area, get out and check for overhanging objects such as trees, branches, or electric wires. It’s easy to miss seeing them while you are backing. (Also check for other hazards at the same time.)

2.7.5 – Space Below
Many drivers forget about the space under their vehicles. That space can be very small when a vehicle is heavily loaded. This is often a problem on dirt roads and in unpaved yards. Don’t take a chance on getting hung up. Drainage channels across roads can cause the ends of some vehicles to drag. Cross such depressions carefully.

Railroad tracks can also cause problems, particularly when pulling trailers with a low underneath clearance. Don’t take a chance on getting hung up halfway across.
2.7.6 – Space for Turns

The space around a truck or bus is important in turns. Because of wide turning and off-tracking, large vehicles can hit other vehicles or objects during turns.

Right Turns. Here are some rules to help prevent right-turn crashes:

- Turn slowly to give yourself and others more time to avoid problems.
- If you are driving a truck or bus that cannot make the right turn without swinging into another lane, turn wide as you complete the turn. Keep the rear of your vehicle close to the curb. This will stop other drivers from passing you on the right.
- Don’t turn wide to the left as you start the turn. A following driver may think you are turning left and try to pass you on the right. You may crash into the other vehicle as you complete your turn.
- If you must cross into the oncoming lane to make a turn, watch out for vehicles coming toward you. Give them room to go by or to stop. However, don’t back up for them, because you might hit someone behind you. See Figure 2.13.

Left Turns. On a left turn, make sure you have reached the center of the intersection before you start the left turn. If you turn too soon, the left side of your vehicle may hit another vehicle because of off-tracking.

- If there are two turning lanes, always take the right turn lane. Don’t start in the inside lane because you may have to swing right to make the turn. Drivers on your left can be more readily seen. See Figure 2.14.

2.7.7 – Space Needed to Cross or Enter Traffic

Be aware of the size and weight of your vehicle when you cross or enter traffic. Here are some important things to keep in mind.

- Because of slow acceleration and the space large vehicles require, you may need a much larger gap to enter traffic than you would in a car.
- Acceleration varies with the load. Allow more room if your vehicle is heavily loaded.
- Before you start across a road, make sure you can get all the way across before traffic reaches you.
2.8 – Seeing Hazards

2.8.1 – Importance of Seeing Hazards

What Is a Hazard? A hazard is any road condition or other road user (driver, bicyclist, pedestrian) that is a possible danger. For example, a car in front of you is headed toward the freeway exit, but his brake lights come on and he begins braking hard. This could mean that the driver is uncertain about taking the off ramp. He might suddenly return to the highway. This car is a hazard. If the driver of the car cuts in front of you, it is no longer just a hazard; it is an emergency.

Seeing Hazards Lets You Be Prepared. You will have more time to act if you see hazards before they become emergencies. In the example above, you might make a lane change or slow down to prevent a crash if the car suddenly cuts in front of you. Seeing this hazard gives you time to check your mirrors and signal a lane change. Being prepared reduces the danger. A driver who did not see the hazard until the slow car pulled back on the highway in front of him would have to do something very suddenly. Sudden braking or a quick lane change is much more likely to lead to a crash.

Learning to See Hazards. There are often clues that will help you see hazards. The more you drive, the better you can learn to see hazards. This section will talk about hazards that you should be aware of.

2.8.2 – Hazardous Roads

Move-Over Laws

The incidents of law enforcement officers, emergency medical services, fire department personnel and people working on the road are being struck while performing duties at the roadside are increasing at a frightening pace. To lessen the problem, move-over laws have been enacted, which require drivers to slow and change lanes when approaching a roadside incident or emergency vehicle. Signs are posted on roadways to remind you of this law.

When approaching an authorized emergency vehicle stopped on the roadside or a work zone, you should proceed with caution by slowing and yielding the right-of-way by making a lane change into a lane not next to that of the authorized emergency vehicle or work zone if safety and traffic conditions permit. If a lane change is unsafe, slow down and proceed with caution while maintaining a safe speed for traffic condition.

Slow down and be very careful if you see any of the following road hazards.

Work Zones. When people are working on the road, it is a hazard. There may be narrower lanes, sharp turns, or uneven surfaces. Other drivers are often distracted and drive unsafely. Workers and construction vehicles may get in the way. Drive slowly and carefully near work zones. Use your four-way flashers or brake lights to warn drivers behind you.

Drop Off. Sometimes the pavement drops off sharply near the edge of the road. Driving too near the edge can tilt your vehicle toward the side of the road. This can cause the top of your vehicle to hit roadside objects (signs, tree limbs). Also, it can be hard to steer as you cross the drop off, going off the road, or coming back on.

Foreign Objects. Things that have fallen on the road can be hazards. They can be a danger to your tires and wheel rims. They can damage electrical and brake lines. They can be caught between dual tires and cause severe damage. Some obstacles that appear to be harmless can be very dangerous. For example, cardboard boxes may be empty, but they may also contain some solid or heavy material capable of causing damage. The same is true of paper and cloth sacks. It is important to remain alert for objects of all sorts, so you can see them early enough to avoid them without making sudden, unsafe moves.

Off Ramps/On Ramps. Freeway and turnpike exits can be particularly dangerous for commercial vehicles. Off ramps and on ramps often have speed limit signs posted. Remember, these speeds may be safe for automobiles, but may not be safe for larger vehicles or heavily loaded vehicles. Exits that go downhill and turn at the same time can be especially dangerous. The downgrade makes it difficult to reduce speed. Braking and turning at the same time can be a dangerous practice. Make sure you are going slowly enough before you get on the curved part of an off ramp or on ramp.

2.8.3 – Drivers Who Are Hazards

In order to protect yourself and others, you must know when other drivers may do something hazardous. Some clues to this type of hazard are discussed below.

Blocked Vision. People who can’t see others are a very dangerous hazard. Be alert for drivers whose vision is blocked. Vans, loaded station wagons, and cars with the rear window blocked are examples. Rental trucks should be watched carefully. Their drivers are often not used to the limited vision they have to the sides and rear of the truck. In winter, vehicles with frosted, ice-covered, or snow-covered windows are hazards.

Vehicles may be partly hidden by blind intersections or alleys. If you only can see the rear or front end of a vehicle but not the driver, then he or she can’t see you. Be alert because he/she may back out or enter into your lane. Always be prepared to stop.

Delivery Trucks Can Present a Hazard. Packages or vehicle doors often block the driver’s vision. Drivers of step vans, postal vehicles, and local delivery vehicles often are in a hurry and may suddenly step out of their vehicle or drive their vehicle into the traffic lane.
Parked Vehicles Can Be Hazards, especially when people start to get out of them. Or, they may suddenly start up and drive into your way. Watch for movement inside the vehicle or movement of the vehicle itself that shows people are inside. Watch for brake lights or backup lights, exhaust, and other clues that a driver is about to move.

Be careful of a stopped bus. Passengers may cross in front of or behind the bus, and they often can’t see you.

Pedestrians and Bicyclists Can Also Be Hazards. Walkers, joggers, and bicyclists may be on the road with their back to the traffic, so they can’t see you. Sometimes they wear portable stereos with headsets, so they can’t hear you either. This can be dangerous. On rainy days, pedestrians may not see you because of hats or umbrellas. They may be hurrying to get out of the rain and may not pay attention to the traffic.

Distractions. People who are distracted are hazards. Watch for where they are looking. If they are looking elsewhere, they can’t see you. But be alert even when they are looking at you. They may believe that they have the right of way.

Children. Children tend to act quickly without checking traffic. Children playing with one another may not look for traffic and are a serious hazard.

Talkers. Drivers or pedestrians talking to one another may not be paying close attention to the traffic.

Workers. People working on or near the roadway are a hazard clue. The work creates a distraction for other drivers and the workers themselves may not see you.

Ice Cream Trucks. Someone selling ice cream is a hazard clue. Children may be nearby and may not see you.

Disabled Vehicles. Drivers changing a tire or fixing an engine often do not pay attention to the danger that roadway traffic is to them. They are often careless. Jacked up wheels or raised hoods are hazard clues.

Accidents. Accidents are particularly hazardous. People involved in the accident may not look for traffic. Passing drivers tend to look at the accident. People often run across the road without looking. Vehicles may slow or stop suddenly.

Shoppers. People in and around shopping areas are often not watching traffic because they are looking for stores or looking into store windows.

Confused Drivers. Confused drivers often change direction suddenly or stop without warning. Confusion is common near freeway or turnpike interchanges and major intersections. Tourists unfamiliar with the area can be very hazardous. Clues to tourists include car-top luggage and out-of-state license plates. Unexpected actions (stopping in the middle of a block, changing lanes for no apparent reason, backup lights suddenly going on) are clues to confusion. Hesitation is another clue, including driving very slowly, using brakes often, or stopping in the middle of an intersection. You may also see drivers who are looking at street signs, maps, and house numbers. These drivers may not be paying attention to you.

Slow Drivers. Motorists who fail to maintain normal speed are hazards. Seeing slow moving vehicles early can prevent a crash. Some vehicles, by their nature, are slow and seeing them is a hazard clue (mopeds, farm machinery, construction machinery, tractors, etc.). Some of these will have the “slow moving vehicle” symbol to warn you. This is a red triangle with an orange center. Watch for it.

Drivers Signaling a Turn May Be a Hazard. Drivers signaling a turn may slow more than expected or stop. If they are making a tight turn into an alley or driveway, they may go very slowly. If pedestrians or other vehicles block them, they may have to stop on the roadway. Vehicles turning left may have to stop for oncoming vehicles.

Drivers in a Hurry. Drivers may feel your commercial vehicle is preventing them from getting where they want to go on time. Such drivers may pass you without a safe gap in the oncoming traffic, cutting too close in front of you. Drivers entering the road may pull in front of you in order to avoid being stuck behind you, causing you to brake. Be aware of this and watch for drivers who are in a hurry.

Impaired Drivers. Drivers who are sleepy, have had too much to drink, are on drugs, or who are ill are hazards. Some clues to these drivers are:

- Weaving across the road or drifting from one side to another.
- Leaving the road (dropping right wheels onto the shoulder, or bumping across a curb in a turn).
- Stopping at the wrong time (stopping at a green light, or waiting for too long at a stop).
- Open window in cold weather.
- Speeding up or slowing down suddenly, driving too fast or too slow.
- Be alert for drunk drivers and sleepy drivers late at night.

Driver Body Movement as a Clue. Drivers look in the direction they are going to turn. You may sometimes get a clue from a driver’s head and body movements that a driver may be going to make a turn, even though the turn signals aren’t on. Drivers making over-the-shoulder checks may be going to change lanes. These clues are most easily seen in motorcyclists and bicyclists. Watch other road users and try to tell whether they might do something hazardous.

Conflicts. You are in conflict when you have to change speed and/or direction to avoid hitting someone. Conflicts occur at intersections where vehicles meet, at merges (such as turnpike on ramps) and where there are needed lane changes (such as the end of a lane, forcing a move to another lane of traffic). Other situations include slow moving or stalled traffic in a traffic lane, and accident scenes. Watch for other drivers who are in conflict because they are a hazard to you. When they react to this conflict, they may do something that will put them in conflict with you.
2.8.4 – Always Have a Plan
You should always be looking for hazards. Continue to learn to see hazards on the road. However, don’t forget why you are looking for the hazards—they may turn into emergencies. You look for the hazards in order to have time to plan a way out of any emergency. When you see a hazard, think about the emergencies that could develop and figure out what you would do. Always be prepared to take action based on your plans. In this way, you will be a prepared, defensive driver who will improve your own safety as well as the safety of all road users.

Subsections 2.7 and 2.8

Test Your Knowledge

1. How do you find out how many seconds of following distance space you have?
2. If you are driving a 30-foot vehicle at 55 mph, how many seconds of following distance should you allow?
3. You should decrease your following distance if somebody is following you too closely. True or False?
4. If you swing wide to the left before turning right, another driver may try to pass you on the right. True or False?
5. What is a hazard?
6. Why make emergency plans when you see a hazard?

These questions may be on the test. If you can’t answer them all, re-read subsections 2.7 and 2.8

2.9 – Distracted Driving

A driver distraction is anything that takes your attention away from driving. Whenever you are driving a vehicle and your full attention is not on the driving task, you are putting yourself, your passengers, other vehicles, and pedestrians in danger. Distracted driving can cause collisions, resulting in injury, death or property damage.

Activities inside of the vehicle that can distract your attention include: talking to passengers; adjusting the radio, CD player or climate controls; eating, drinking or smoking; reading maps or other literature; picking up something that fell; talking on a cell phone or CB radio; reading or sending text messages; using any type of telematic or electronic devices (such as navigation systems, pagers, personal digital assistant, computers, etc.); daydreaming or being occupied with other mental distractions; and many others.

Possible distractions that could occur outside a moving vehicle: outside traffic, vehicles or pedestrians; outside events such as police pulling someone over or a crash scene; sunlight/sunset; objects in roadway; road construction; reading billboards or other road advertisements; and many others.

2.9.1 – The Distracted Driving Crash Problem

The Large Truck Crash Causation Study (LTCCS) reported that 8 percent of large-truck crashes occurred when Commercial Motor Vehicle (CMV) drivers were externally distracted and 2 percent of large truck crashes occurred when the driver was internally distracted.

Approximately 5,500 people are killed each year on U.S. roadways and an estimated 448,000 are injured in motor vehicle crashes involving distracted driving (NHTSA Traffic Safety Facts: Distracted Driving).

Research indicates that the burden of talking on a cell phone - even if it’s hands-free - saps the brain of 39% of the energy it would ordinarily devote to safe driving. Drivers who use a hand-held device are more likely to get into a crash serious enough to cause injury. (NHTSA distracted driving website, www.distraction.gov)

2.9.2 – Effects of Distracted Driving

Effects of distracted driving include slowed perception, which may cause you to be delayed in perceiving or completely fail to perceive an important traffic event; delayed decision making and improper action, which can cause you to be delayed in taking the proper action or make incorrect inputs to the steering, accelerator or brakes.
2.9.3 – Types of Distractions
There are many causes of distraction, all with the potential to increase risk.

Physical distraction – one that causes you to take your hands off the wheel or eyes off the road, such as reaching for an object.

Mental distraction – activities that take your mind away from the road, such as engaging in conversation with a passenger or thinking about something that happened during the day.

Both physical and mental distraction – even greater chance a crash could happen, such as talking on a cell phone; or sending or reading text messages.

2.9.4 – Cell/Mobile Phones
49 CFR Part 383, 384, 390, 391, and 392 of the Federal Motor Carrier Safety Regulations (FMCSRs) and the Hazardous Materials Regulations (HMR) restricts the use of hand-held mobile telephones by drivers of commercial motor vehicles (CMVs); and implements new driver disqualification sanctions for drivers of CMVs who fail to comply with this Federal restriction; or who have multiple convictions for violating a State or local law or ordinance on motor vehicle traffic control that restricts the use of hand-held mobile telephones. Additionally, motor carriers are prohibited from requiring or allowing drivers of CMVs to use hand-held mobile telephones.

The use of hand-held mobile telephones means, “using at least one hand to hold a mobile telephone to conduct a voice communication; “dialing a mobile telephone by pressing more than a single button”; or “moving from a seated driving position while restrained by a seat belt to reach for a mobile telephone”. If you choose to use a mobile phone while operating a CMV, you may only use a hands free mobile phone that is located close to you and that can be operated in compliance with the rule to conduct a voice communication.

Your CDL will be disqualified after two or more convictions of any state law on hand-held mobile telephone use while operating a CMV. Disqualification is 60 days for the second offense within 3 years and 120 days for three or more offenses within 3 years. In addition, the first and each subsequent violation of such a prohibition are subject to civil penalties imposed on such drivers, in an amount up to $2,750. Motor carriers must not allow nor require drivers to use a hand-held mobile telephone while driving. Employers may also be subject to civil penalties in an amount up to $11,000. There is an emergency exception that allows you to use your hand-held mobile telephones if necessary to communicate with law enforcement officials or other emergency services.

Research shows that the odds of being involved in a safety-critical event (e.g., crash, near-crash, unintentional lane deviation) is 6 times greater for CMV drivers who engage in dialing a mobile telephone while driving than for those who do not. Dialing drivers took their eyes off the forward roadway for an average of 3.8 seconds. At 55 mph (or 80.7 feet per second), this equates to a driver traveling 306 feet, the approximate length of a football field, without looking at the roadway.

Your primary responsibility is to operate a motor vehicle safely. To do this, you must focus your full attention on the driving task. Note that hands-free devices are no less likely than hand-held cell phones to cause you to become distracted. Attention is diverted from the driving task while using either device.

2.9.5 – Texting
49 CFR Part 383, 384, 390, 391, 392, the Federal Motor Carrier Safety Regulations (FMCSR) prohibits texting by commercial motor vehicle (CMV) drivers while operating in interstate commerce; and implements new driver disqualification sanctions for drivers of CMVs who fail to comply with this Federal prohibition; or who have multiple convictions for violating a State or local law or ordinance on motor vehicle traffic control that prohibits texting while driving. Additionally, motor carriers are prohibited from requiring or allowing their drivers to engage in texting while driving.

Texting means manually entering text into, or reading text from, an electronic device. This includes, but is not limited to, short message service, e-mailing, instant messaging, a command or request to access a World Wide Web page, or engaging in any other form of electronic text retrieval or entry, for present or future communication.

Electronic device includes, but is not limited to, a cellular telephone; personal digital assistant; pager; computer; or any other device used to enter, write, send, receive, or read text.

Your CDL will be disqualified after two or more convictions of any state law on texting while operating a CMV. Disqualification is 60 days for the second offense within 3 years and 120 days for three or more offenses within 3 years. In addition, the first and each subsequent violation of such a prohibition are subject to civil penalties imposed on such drivers, in an amount up to $2,750. No motor carrier shall allow or require its drivers to engage in texting while driving. There is an emergency exception that allows you text if necessary to communicate with law enforcement officials or other emergency services.

Evidence suggests that text messaging is even riskier than talking on a cell phone because it requires you to look at a small screen and manipulate the keypad with one’s hands. Texting is the most alarming distraction because it involves both physical and mental distraction simultaneously.

Research shows that the odds of being involved in a safety-critical event (e.g., crash, near-crash, unintentional lane deviation) is 23.2 times greater for CMV drivers who engage in texting while driving than for those who do not. Sending or receiving text takes your eyes from the road for an average of 4.6 seconds. At 55 mph, you would travel 371 feet, or the length of an entire football field – without looking at the roadway.
2.9.6 – Don’t Drive Distracted

Your goal should be to eliminate all in-vehicle distractions before driving begins. Accomplishing this goal can be done by:

- Assessing all potential in-vehicle distractions before driving
- Developing a preventative plan to reduce/eliminate possible distractions
- Expecting distractions to occur
- Discussing possible scenarios before getting behind the wheel

Based on the assessment of potential distractions, you can formulate a preventative plan to reduce/eliminate possible distractions.

If drivers react a half-second slower because of distractions, crashes double. Some tips to follow so you won’t become distracted:

- Turn off all communication devices.
- If you must use a mobile phone, make sure it is within close proximity, that it is operable while you are restrained, use an earpiece or the speaker phone function, use voice-activated dialing; or use the hands-free feature. Drivers are not in compliance if they unsafely reach for a mobile phone, even if they intend to use the hands-free function.
- Do not type or read a text message on a mobile device while driving.
- Familiarize yourself with your vehicle’s features and equipment, before you get behind the wheel.
- Adjust all vehicle controls and mirrors to your preferences prior to driving.
- Pre-program radio stations and pre-load your favorite CDs.
- Clear the vehicle of any unnecessary objects and secure cargo.
- Review maps, program the GPS and plan your route before you begin driving.
- Don’t attempt to read or write while you drive.
- Avoid smoking, eating and drinking while you drive. Leave early to allow yourself time to stop to eat.
- Don’t engage in complex or emotionally intense conversations with other occupants.
- Secure commitment from other occupants to behave responsibly and to support the driver in reducing distractions.

2.9.7 – Watch Out for Other Distracted Drivers

You need to be able to recognize other drivers who are engaged in any form of driving distraction. Not recognizing other distracted drivers can prevent you from perceiving or reacting correctly in time to prevent a crash. Watch for:

- Vehicles that may drift over the lane divider lines or within their own lane.
- Vehicles traveling at inconsistent speeds. Drivers who are preoccupied with maps, food, cigarettes, cell phones, or other objects.
- Drivers who appear to be involved in conversations with their passengers.

Give a distracted driver plenty of room and maintain your safe following distance.

Be very careful when passing a driver who seems to be distracted. The other driver may not be aware of your presence, and they may drift in front of you.

2.10 – Aggressive Drivers/Road Rage

2.10.1 – What Is It?

Aggressive driving and road rage is not a new problem. However, in today’s world, where heavy and slow-moving traffic and tight schedules are the norm, more and more drivers are taking out their anger and frustration in their vehicles.

Crowded roads leave little room for error, leading to suspicion and hostility among drivers and encouraging them to take personally the mistakes of other drivers.

Aggressive driving is the act of operating a motor vehicle in a selfish, bold, or pushy manner, without regard for the rights or safety of others.

Road rage is operating a motor vehicle with the intent of doing harm to others or physically assaulting a driver or their vehicle.

2.10.2 – Don’t Be an Aggressive Driver

How you feel before you even start your vehicle has a lot to do with how stress will affect you while driving.

Reduce your stress before and while you drive.

Listen to “easy listening” music.

Give the drive your full attention. Don’t allow yourself to become distracted by talking on your cell phone, eating, etc.

Be realistic about your travel time. Expect delays because of traffic, construction, or bad weather and make allowances.

If you’re going to be later than you expected – deal with it. Take a deep breath and accept the delay.

Give other drivers the benefit of the doubt. Try to imagine why he or she is driving that way. Whatever their reason, it has nothing to do with you.

Slow down and keep your following distance reasonable.
Don’t drive slowly in the left lane of traffic. 
Avoid gestures. Keep your hands on the wheel. Avoid making any gestures that might anger another driver, even seemingly harmless expressions of irritation like shaking your head.
Be a cautious and courteous driver. If another driver seems eager to get in front of you, say, “Be my guest.” This response will soon become a habit and you won’t be as offended by other drivers’ actions.

**2.10.3 – What You Should Do When Confronted by an Aggressive Driver**

First and foremost, make every attempt to get out of their way.
Put your pride in the back seat. Do not challenge them by speeding up or attempting to hold-your-own in your travel lane. 
Avoid eye contact.
Ignore gestures and refuse to react to them.
Report aggressive drivers to the appropriate authorities by providing a vehicle description, license number, location and, if possible, direction of travel.
If you have a cell phone, and can do it safely, call the police.
If an aggressive driver is involved in a crash farther down the road, stop a safe distance from the crash scene, wait for the police to arrive, and report the driving behavior that you witnessed.

**Subsections 2.9 and 2.10**

**Test Your Knowledge**

1. What are some tips to follow so you won’t become a distracted driver?
2. How do you use in-vehicle communications equipment cautiously?
3. How do you recognize a distracted driver?
4. What is the difference between aggressive driving and road rage?
5. What should you do when confronted with an aggressive driver?
6. What are some things you can do to reduce your stress before and while you drive?

These questions may be on the test. If you can’t answer them all, re-read subsections 2.9 and 2.10.
2.11 – Driving at Night

2.11.1 – It’s More Dangerous

You are at greater risk when you drive at night. Drivers can’t see hazards as quickly as in daylight, so they have less time to respond. Drivers caught by surprise are less able to avoid a crash.

The problems of night driving involve the driver, the roadway, and the vehicle.

2.11.2 – Driver Factors

Vision. Good vision is critical for safe driving. Your control of the brake, accelerator, and steering wheel is based on what you see. If you cannot see clearly, you will have trouble identifying traffic and roadway conditions, spotting potential trouble or responding to problems in a timely manner.

Because seeing well is so critical to safe driving, you should have your eyes checked regularly by an eye specialist. You may never know you have poor vision unless your eyes are tested. If you need to wear glasses or contact lenses for driving, remember to:

- Always wear them when driving, even if driving short distances. If your driver license says corrective lenses are required, it is illegal to move a vehicle without using corrective lenses.
- Keep an extra set of corrective lenses in your vehicle. If your normal corrective lenses are broken or lost, you can use the spare lenses to drive safely.
- Avoid using dark or tinted corrective lenses at night, even if you think they help with glare. Tinted lenses cut down the light that you need to see clearly under night driving conditions.

Glare. Drivers can be blinded for a short time by bright light. It can take several seconds to recover from glare. Even two seconds of glare blindness can be dangerous. A vehicle going 55 mph will travel more than half the distance of a football field during that time.

Fatigue and Lack of Alertness. Fatigue is physical or mental tiredness that can be caused by physical or mental strain, repetitive tasks, illness or lack of sleep. Just like alcohol and drugs, it impairs your vision and judgment.

Fatigue causes errors related to speed and distance, increases your risk of being in a crash, causes you to not see and react to hazards as quickly; and affects your ability to make critical decisions. When you are fatigued, you could fall asleep behind the wheel and crash, injuring or killing yourself or others.

Fatigued or drowsy driving is one of the leading causes of traffic collisions. NHTSA estimates that 100,000 police-reported crashes a year are the result of drowsy driving. According to the National Sleep Foundation’s Sleep in America poll, 60% of Americans have driven while feeling sleepy and more than one third (36 percent or 103 million people) admit to having actually fallen asleep at the wheel. Drivers may experience short bursts of sleep lasting only a few seconds or fall asleep for longer periods of time. Either way, the chance of a collision increases dramatically.

At-Risk Groups

The risk of having a crash due to drowsy driving is not uniformly distributed across the population. Crashes tend to occur at times when sleepiness is most pronounced, for example, during the night and in the mid-afternoon. Most people are less alert at night, especially after midnight. This is particularly true if you have been driving for a long time. Thus individuals who drive at night are much more likely to have fall-asleep crashes.

Research has identified young males, shift workers, commercial drivers, especially long-haul drivers and people with untreated sleep disorders or with short-term or chronic sleep deprivation as being at increased risk for having a fall-asleep crash. At least 15% of all heavy truck crashes involve fatigue.

A congressionally mandated study of 80 long-haul truck drivers in the United States and Canada found that drivers averaged less than 5 hours of sleep per day. (Federal Motor Carrier Safety Administration, 1996) It is no surprise then that the National Transportation Safety Board (NTSB) reported that drowsy driving was probably the cause of more than half of crashes leading to a truck driver’s death. (NTSB, 1990) For each truck driver fatality, another three to four people are killed. (NHTSA, 1994)

Warning Signs of Fatigue

According to the National Sleep Foundation’s Sleep in America poll, 60% of Americans have driven while feeling sleepy and 36% admit to actually having fallen asleep at the wheel in the past year. However, many people cannot tell if or when they are about to fall asleep. Here are some signs that should tell you to stop and rest:

- Difficulty focusing, frequent blinking or heavy eyelids
- Yawning repeatedly or rubbing eyes
- Day-dreaming; or wandering/disconnected thoughts
- Trouble remembering the last few miles driven; missing exits or traffic signs
- Trouble keeping head up
- Drifting from your lane, following too closely or hitting a shoulder rumble strip
- Feeling restless and irritable

When you are tired trying to “push on” is far more dangerous than most drivers think. It is a major cause of fatal accidents. If you notice any signs of fatigue, stop driving and go to sleep for the night or take a 15-20 minute nap.
Are You At Risk?

Before you drive, consider whether you are:

- Sleep-deprived or fatigued (6 hours of sleep or less triples your risk)
- Suffering from sleep loss (insomnia), poor quality sleep, or a sleep debt
- Driving long distances without proper rest breaks
- Driving through the night, mid-afternoon or when you would normally be asleep. Many heavy motor vehicle accidents occur between midnight and 6 a.m.
- Taking sedating medications (antidepressants, cold tablets, antihistamines)
- Working more than 60 hours a week (increases your risk by 40%)
- Working more than one job, and your main job involves shift work
- Driving alone or on a long, rural, dark or boring road
- Flying, changing time zone

Preventing drowsiness before a trip:

- Get adequate sleep – adults need 8 to 9 hours to maintain alertness
- Prepare route carefully to identify total distance, stopping points and other logistic considerations
- Schedule trips for the hours you are normally awake, not the middle of the night
- Drive with a passenger
- Avoid medications that cause drowsiness
- Consult your physician if you suffer from daytime sleepiness, have difficulty sleeping at night or take frequent naps
- Incorporate exercise into your daily life to give you more energy

Maintaining alertness while driving:

- Protect yourself from glare and eyestrain with sunglasses
- Keep cool by opening the window or using the air conditioner
- Avoid heavy foods
- Be aware of down time during the day
- Have another person ride with you, and take turns driving
- Take periodic breaks – about every 100 miles or 2 hours during long trips
- Stop driving and get some rest or take a nap
- Caffeine consumption can increase awareness for a few hours, but do not drink too much. It will eventually wear off. Do not rely on caffeine to prevent fatigue
- Avoid drugs. While they may keep you awake for a while, they won’t make you alert.
- If you are drowsy, the only safe cure is to get off the road and get some sleep. If you don’t, you risk your life and the lives of others.

2.11.3 – Roadway Factors

Poor Lighting. In the daytime there is usually enough light to see well. This is not true at night. Some areas may have bright street lights, but many areas will have poor lighting. On most roads you will probably have to depend entirely on your headlights.

Less light means you will not be able to see hazards as well as in daytime. Road users who do not have lights are hard to see. There are many accidents at night involving pedestrians, joggers, bicyclists, and animals.

Even when there are lights, the road scene can be confusing. Traffic signals and hazards can be hard to see against a background of signs, shop windows, and other lights.

Drive slower when lighting is poor or confusing. Drive slowly enough to be sure you can stop in the distance you can see ahead.

Drunk Drivers. Drunk drivers and drivers under the influence of drugs are a hazard to themselves and to you. Be especially alert around the closing times for bars and taverns. Watch for drivers who have trouble staying in their lane or maintaining speed, who stop without reason, or show other signs of being under the influence of alcohol or drugs.

2.11.4 – Vehicle Factors

Headlights. At night your headlights will usually be the main source of light for you to see by and for others to see you. You can’t see nearly as much with your headlights as you see in the daytime. With low beams you can see ahead about 250 feet and with high beams about 350-500 feet.

You must adjust your speed to keep your stopping distance within your sight distance. This means going slowly enough to be able to stop within the range of your headlights. Otherwise, by the time you see a hazard, you will not have time to stop.

Night driving can be more dangerous if you have problems with your headlights. Dirty headlights may give only half the light they should. This cuts down your ability to see, and makes it harder for others to see you. Make sure your lights are clean and working. Headlights can be out of adjustment. If they don’t point in the right direction, they won’t give you a good view and they can blind other drivers. Have a qualified person make sure they are adjusted properly.

Other Lights. In order for you to be seen easily, the following must be clean and working properly:

- Reflectors.
- Marker lights.
- Clearance lights.
- Taillights.
- Identification lights.
**Turn Signals and Brake Lights.** At night your turn signals and brake lights are even more important for telling other drivers what you intend to do. Make sure you have clean, working turn signals and stop lights.

**Windshield and Mirrors.** It is more important at night than in the daytime to have a clean windshield and clean mirrors. Bright lights at night can cause dirt on your windshield or mirrors to create a glare of its own, blocking your view. Most people have experienced driving toward the sun just as it has risen or is about to set, and found that they can barely see through a windshield that seemed to look OK in the middle of the day. Clean your windshield on the inside and outside for safe driving at night.

**2.11.5 – Night Driving Procedures**

**Vehicle Procedures.** Make sure you are rested and alert. If you are drowsy, sleep before you drive! Even a nap can save your life or the lives of others. If you wear eyeglasses, make sure they are clean and unscratched. Don’t wear sunglasses at night. Do a complete Vehicle inspection of your vehicle. Pay attention to checking all lights and reflectors, and cleaning those you can reach.

**Avoid Blinding Others.** Glare from your headlights can cause problems for drivers coming toward you. They can also bother drivers going in the same direction you are, when your lights shine in their rearview mirrors. Dim your lights before they cause glare for other drivers. Dim your lights within 500 feet of an oncoming vehicle and when following another vehicle within 500 feet.

**Avoid Glare from Oncoming Vehicles.** Do not look directly at lights of oncoming vehicles. Look slightly to the right at a right lane or edge marking, if available. If other drivers don’t put their low beams on, don’t try to “get back at them” by putting your own high beams on. This increases glare for oncoming drivers and increases the chance of a crash.

**Use High Beams When You Can.** Some drivers make the mistake of always using low beams. This seriously cuts down on their ability to see ahead. Use high beams when it is safe and legal to do so. Use them when you are not within 500 feet of an approaching vehicle. Also, don’t let the inside of your cab get too bright. This makes it harder to see outside. Keep the interior light off, and adjust your instrument lights as low as you can to still be able to read the gauges.

**If You Get Sleepy, Stop at the Nearest Safe Place.** People often don’t realize how close they are to falling asleep even when their eyelids are falling shut. If you can safely do so, look at yourself in a mirror. If you look sleepy, or you just feel sleepy, stop driving! You are in a very dangerous condition. The only safe cure is to sleep.

**2.12 – Driving in Fog**

Fog can occur at any time. Fog on highways can be extremely dangerous. Fog is often unexpected, and visibility can deteriorate rapidly. You should watch for foggy conditions and be ready to reduce your speed. Do not assume that the fog will thin out after you enter it.

The best advice for driving in fog is don’t. It is preferable that you pull off the road into a rest area or truck stop until visibility is better. If you must drive, be sure to consider the following:

- Obey all fog-related warning signs. Slow down before you enter fog.
- Use low-beam headlights and fog lights for best visibility even in daytime, and be alert for other drivers who may have forgotten to turn on their lights.
- Turn on your 4-way flashers. This will give vehicles approaching you from behind a quicker opportunity to notice your vehicle.
- Watch for vehicles on the side of the roadway. Seeing taillights or headlights in front of you may not be a true indication of where the road is ahead of you. The vehicle may not be on the road at all.
- Use roadside highway reflectors as guides to determine how the road may curve ahead of you.
- Listen for traffic you cannot see. Avoid passing other vehicles.
- Don’t stop along the side of the road, unless absolutely necessary.

**2.13 – Driving in Winter**

**2.13.1 – Vehicle Checks**

Make sure your vehicle is ready before driving in winter weather. You should make a regular Vehicle inspection, paying extra attention to the following items:

- **Coolant Level and Antifreeze Amount.** Make sure the cooling system is full and there is enough antifreeze in the system to protect against freezing. This can be checked with a special coolant tester.
- **Defrosting and Heating Equipment.** Make sure the defrosters work. They are needed for safe driving. Make sure the heater is working, and that you know how to operate it. If you use other heaters and expect to need them (e.g., mirror heaters, battery box heaters, fuel tank heaters), check their operation.
- **Wipers and Washers.** Make sure the windshield wiper blades are in good condition. Make sure the wiper blades press against the window hard enough to wipe the windshield clean, otherwise they may not sweep off snow properly. Make sure the windshield washer works and there is washing fluid in the washer reservoir.
Use windshield washer antifreeze to prevent freezing of the washer liquid. If you can’t see well enough while driving (for example, if your wipers fail), stop safely and fix the problem.

**Tires.** Make sure you have enough tread on your tires. The drive tires must provide traction to push the rig over wet pavement and through snow. The steering tires must have traction to steer the vehicle. Enough tread is especially important in winter conditions. You must have at least \(\frac{4}{32}\) inch tread depth in every major groove on front tires and at least \(\frac{2}{32}\) inch on other tires. More would be better.

Use a gauge to determine if you have enough tread for safe driving.

**Tire Chains.** You may find yourself in conditions where you can’t drive without chains, even to get to a place of safety. Carry the right number of chains and extra cross-links. Make sure they will fit your drive tires. Check the chains for broken hooks, worn or broken cross-links, and bent or broken side chains. Learn how to put the chains on before you need to do it in snow and ice.

**Lights and Reflectors.** Make sure the lights and reflectors are clean. Lights and reflectors are especially important during bad weather. Check from time to time during bad weather to make sure they are clean and working properly.

**Windows and Mirrors.** Remove any ice, snow, etc., from the windshield, windows, and mirrors before starting. Use a windshield scraper, snow brush, and windshield defroster as necessary.

**Hand Holds, Steps, and Deck Plates.** Remove all ice and snow from hand holds, steps, and deck plates. This will reduce the danger of slipping.

**Radiator Shutters and Winterfront.** Remove ice from the radiator shutters. Make sure the winterfront is not closed too tightly. If the shutters freeze shut or the winterfront is closed too much, the engine may overheat and stop.

**Exhaust System.** Exhaust system leaks are especially dangerous when cab ventilation may be poor (windows rolled up, etc.). Loose connections could permit poisonous carbon monoxide to leak into your vehicle. Carbon monoxide gas will cause you to be sleepy. In large enough amounts it can kill you. Check the exhaust system for loose parts and for sounds and signs of leaks.

**2.13.2 – Driving**

**Slippery Surfaces.** Drive slowly and smoothly on slippery roads. If it is very slippery, you shouldn’t drive at all. Stop at the first safe place.

**Start Gently and Slowly.** When first starting, get the feel of the road. Don’t hurry.

**Check for Ice.** Check for ice on the road, especially bridges and overpasses. A lack of spray from other vehicles indicates ice has formed on the road. Also, check your mirrors and wiper blades for ice. If they have ice, the road most likely will be icy as well.

**Adjust Turning and Braking to Conditions.** Make turns as gently as possible. Don’t brake any harder than necessary, and don’t use the engine brake or speed retarder. (They can cause the driving wheels to skid on slippery surfaces.)

**Adjust Speed to Conditions.** Don’t pass slower vehicles unless necessary. Go slowly and watch far enough ahead to keep a steady speed. Avoid having to slow down and speed up. Take curves at slower speeds and don’t brake while in curves. Be aware that as the temperature rises to the point where ice begins to melt, the road becomes even more slippery. Slow down more.

**Adjust Space to Conditions.** Don’t drive alongside other vehicles. Keep a longer following distance. When you see a traffic jam ahead, slow down or stop to wait for it to clear. Try hard to anticipate stops early and slow down gradually. Watch for snowplows, as well as salt and sand trucks, and give them plenty of room.

**Wet Brakes.** When driving in heavy rain or deep standing water, your brakes will get wet. Water in the brakes can cause the brakes to be weak, to apply unevenly, or to grab. This can cause lack of braking power, wheel lockups, pulling to one side or the other, and jackknife if you pull a trailer. Avoid driving through deep puddles or flowing water if possible. If not, you should:

- Slow down and place transmission in a low gear. Gently put on the brakes. This presses linings against brake drums or discs and keeps mud, silt, sand, and water from getting in.
- Increase engine rpm and cross the water while keeping light pressure on the brakes.
- When out of the water, maintain light pressure on the brakes for a short distance to heat them up and dry them out.
- Make a test stop when safe to do so. Check behind to make sure no one is following, then apply the brakes to be sure they work well. If not, dry them out further as described above. (CAUTION: Do not apply too much brake pressure and accelerator at the same time, or you can overheat brake drums and linings.)
2.14 – Driving in Very Hot Weather

2.14.1 – Vehicle Checks

Do a normal Vehicle inspection, but pay special attention to the following items:

**Tires.** Check the tire mounting and air pressure. Inspect the tires every two hours or every 100 miles when driving in very hot weather. Air pressure increases with temperature. Do not let air out or the pressure will be too low when the tires cool off. If a tire is too hot to touch, remain stopped until the tire cools off. Otherwise the tire may blow out or catch fire.

**Engine Oil.** The engine oil helps keep the engine cool, as well as lubricating it. Make sure there is enough engine oil. If you have an oil temperature gauge, make sure the temperature is within the proper range while you are driving.

**Engine Coolant.** Before starting out, make sure the engine cooling system has enough water and antifreeze according to the engine manufacturer’s directions. (Antifreeze helps the engine under hot conditions as well as cold conditions.) When driving, check the water temperature or coolant temperature gauge from time to time. Make sure that it remains in the normal range. If the gauge goes above the highest safe temperature, there may be something wrong that could lead to engine failure and possibly fire. Stop driving as soon as safely possible and try to find out what is wrong.

Some vehicles have sight glasses, see-through coolant overflow containers, or coolant recovery containers. These permit you to check the coolant level while the engine is hot. If the container is not part of the pressurized system, the cap can be safely removed and coolant added even when the engine is at operating temperature.

Never remove the radiator cap or any part of the pressurized system until the system has cooled. Steam and boiling water can spray under pressure and cause severe burns. If you can touch the radiator cap with your bare hand, it is probably cool enough to open.

If coolant has to be added to a system without a recovery tank or overflow tank, follow these steps:

- Shut engine off.
- Wait until engine has cooled.
- Protect hands (use gloves or a thick cloth).
- Turn radiator cap slowly to the first stop, which releases the pressure seal.
- Step back while pressure is released from cooling system.
- When all pressure has been released, press down on the cap and turn it further to remove it.
- Visually check level of coolant and add more coolant if necessary.
- Replace cap and turn all the way to the closed position.

**Engine Belts.** Learn how to check v-belt tightness on your vehicle by pressing on the belts. Loose belts will not turn the water pump and/or fan properly. This will result in overheating. Also, check belts for cracking or other signs of wear.

**Hoses.** Make sure coolant hoses are in good condition. A broken hose while driving can lead to engine failure and even fire.

2.14.2 – Driving

**Watch for Bleeding Tar.** Tar in the road pavement frequently rises to the surface in very hot weather. Spots where tar “bleeds” to the surface are very slippery.

**Go Slowly Enough to Prevent Overheating.** High speeds create more heat for tires and the engine. In desert conditions the heat may build up to the point where it is dangerous. The heat will increase chances of tire failure or even fire, and engine failure.

Subsections 2.11, 2.12, 2.13, and 2.14

Test Your Knowledge

1. You should use low beams whenever you can. True or False?
2. What should you do before you drive if you are drowsy?
3. What effects can wet brakes cause? How can you avoid these problems?
4. You should let air out of hot tires so the pressure goes back to normal. True or False?
5. You can safely remove the radiator cap as long as the engine isn’t overheated. True or False?

These questions may be on the test. If you can’t answer all of them, re-read subsections 2.11, 2.12, 2.13, and 2.14.
2.15 – Railroad-highway Crossings
Railroad-highway grade crossings are a special kind of intersection where the roadway crosses train tracks. These crossings are always dangerous. Every such crossing must be approached with the expectation that a train is coming. It is extremely difficult to judge the distance of the train from the crossing as well as the speed of an approaching train.

2.15.1 – Types of Crossings
Passive Crossings. This type of crossing does not have any type of traffic control device. For non-School Bus’ and non-Hazardous Material vehicles the decision to stop or proceed rests entirely in your hands. Passive crossings require you to recognize the crossing, search for any train using the tracks and decide if there is sufficient clear space to cross safely.

Active Crossings. This type of crossing has a traffic control device installed at the crossing to regulate traffic at the crossing. These active devices include flashing red lights, with or without bells and flashing red lights with bells and gates.

2.15.2 – Warning Signs and Devices
Advance Warning Signs. The round, black-on- yellow warning sign is placed ahead of a public railroad-highway crossing. The advance warning sign tells you to slow down, look and listen for the train, and be prepared to stop at the tracks if a train is coming. All passenger and hazmat carrying vehicles are required to stop. See Figure 2.15.

Pavement Markings. Pavement markings mean the same as the advance warning sign. They consist of an “X” with the letters “RR” and a no-passing marking on two-lane roads. See Figure 2.16.

There is also a no passing zone sign on two-lane roads. There may be a white stop line painted on the pavement before the railroad tracks. The front of the school bus or Hazardous material vehicle must remain behind this line while stopped at the crossing.

Cross-buck Signs. This sign marks the grade crossing. It requires you to yield the right-of-way to the train. If there is no white stop line painted on the pavement, vehicles that are required to stop must stop no closer than 15 feet or more than 50 feet from the nearest rail of the nearest track. When the road crosses over more than one track, a sign below the cross-buck indicates the number of tracks. See Figure 2.17.

Flashing Red Light Signals. At many highway-rail grade crossings, the cross-buck sign has flashing red lights and bells. When the lights begin to flash, stop! A train is approaching. You are required to yield the right-of-way to the train. If there is more than one track, make sure all tracks are clear before crossing. See Figure 2.18.

Gates. Many railroad-highway crossings have gates with flashing red lights and bells. Stop when the lights begin to flash and before the gate lowers across the road lane. Remain stopped until the gates go up and the lights have stopped flashing. Proceed when it is safe. See Figure 2.18.

2.15.3 – Driving Procedures
Never Race a Train to a Crossing. Never attempt to race a train to a crossing. It is extremely difficult to judge the speed of an approaching train.

Reduce Speed. Speed must be reduced in accordance with your ability to see approaching trains in any direction, and speed must be held to a point which will permit you to stop short of the tracks in case a stop is necessary.

Don't Expect to Hear a Train. Trains may not or are prohibited from sounding horns when approaching some crossings. Public crossings where trains do not sound horns should be identified by signs. Noise inside your vehicle may, also prevent you from hearing the train horn until the train is dangerously close to the crossing.

Don't Rely on Signals. You should not rely solely upon the presence of warning signals, gates, or flagmen to warn of the approach of trains. Be especially alert at crossings that do not have gates or flashing red light signals.

Double Tracks Require a Double Check. Remember that a train on one track may hide a train on the other track. Look both ways before crossing.

After one train has cleared a crossing, be sure no other trains are near before starting across the tracks.
Yard Areas and Grade Crossings in Cities and Towns.
Yard areas and grade crossings in cities and towns are just as dangerous as rural grade crossings. Approach them with as much caution.

2.15.4 – Stopping Safely at Railroad - Highway Crossings
A full stop is required at grade crossings whenever:
- Operating a vehicle that is placard for hazardous material.
- Operating a School Bus.
When stopping be sure to:
- Check for traffic behind you while stopping gradually. Do not create a second lane for traffic.
- Turn on your four-way emergency flashers.

2.15.5 – Crossing the Tracks
Railroad crossings with steep approaches can cause your unit to hang up on the tracks.
Never permit traffic conditions to trap you in a position where you have to stop on the tracks. Be sure you can get all the way across the tracks before you start across. It takes a typical tractor-trailer unit at least 14 seconds to clear a single track and more than 15 seconds to clear a double track.
Do not shift gears while crossing railroad tracks.

2.15.6 – Special Situations
Be Aware! These trailers can get stuck on raised crossings:
- Low slung units (lowboy, car carrier, moving van, possum-belly livestock trailer).
- Single-axle tractor pulling a long trailer with its landing gear set to accommodate a tandem-axle tractor.
If for any reason you get stuck on the tracks, get out of the vehicle and away from the tracks. Check signposts or signal housing at the crossing for emergency notification information. Call 911 or other emergency number. Give the location of the crossing using all identifiable landmarks, especially the DOT number, if posted.

2.16 – Mountain Driving
In mountain driving, gravity plays a major role. On any upgrade, gravity slows you down. The steeper the grade, the longer the grade, and/or the heavier the load—the more you will have to use lower gears to climb hills or mountains. In coming down long, steep downgrades, gravity causes the speed of your vehicle to increase. You must select an appropriate safe speed, then use a low gear, and proper braking techniques. You should plan ahead and obtain information about any long, steep grades along your planned route of travel. If possible, talk to other drivers who are familiar with the grades to find out what speeds are safe.
You must go slowly enough so your brakes can hold you back without getting too hot. If the brakes become too hot, they may start to “fade.” This means you have to apply them harder and harder to get the same stopping power. If you continue to use the brakes hard, they can keep fading until you cannot slow down or stop at all.

2.16.1 – Select a “Safe” Speed
Your most important consideration is to select a speed that is not too fast for the:
- Total weight of the vehicle and cargo.
- Length of the grade.
- Steepness of the grade.
- Road conditions.
- Weather.
If a speed limit is posted, or there is a sign indicating “Maximum Safe Speed,” never exceed the speed shown. Also, look for and heed warning signs indicating the length and steepness of the grade.
You must use the braking effect of the engine as the principal way of controlling your speed. The braking effect of the engine is greatest when it is near the governed rpms and the transmission is in the lower gears. Save your brakes so you will be able to slow or stop as required by road and traffic conditions.
2.16.2 – Select the Right Gear before Starting Down the Grade

Shift the transmission to a low gear before starting down the grade. Do not try to downshift after your speed has already built up. You will not be able to shift into a lower gear. You may not even be able to get back into any gear and all engine braking effect will be lost. Forcing an automatic transmission into a lower gear at high speed could damage the transmission and also lead to loss of all engine braking effect.

With older trucks, a rule for choosing gears is to use the same gear going down a hill that you would need to climb the hill. However, new trucks have low friction parts and streamlined shapes for fuel economy. They may also have more powerful engines. This means they can go up hills in higher gears and have less friction and air drag to hold them back going down hills. For that reason, drivers of modern trucks may have to use lower gears going down a hill than would be required to go up the hill. You should know what is right for your vehicle.

2.16.3 – Brake Fading or Failure

Brakes are designed so brake shoes or pads rub against the brake drum or disks to slow the vehicle. Braking creates heat, but brakes are designed to take a lot of heat. However, brakes can fade or fail from excessive heat caused by using them too much and not relying on the engine braking effect. Brake fade is also affected by adjustment. To safely control a vehicle, every brake must do its share of the work. Brakes out of adjustment will stop doing their share before those that are in adjustment. The other brakes can then overheat and fade, and there will not be enough braking available to control the vehicle. Brakes can get out of adjustment quickly, especially when they are used a lot; also, brake linings wear faster when they are hot. Therefore, brake adjustment must be checked frequently.

2.16.4 – Proper Braking Technique

Remember. The use of brakes on a long and/or steep downgrade is only a supplement to the braking effect of the engine. Once the vehicle is in the proper low gear, the following are the proper braking techniques:

Apply the brakes just hard enough to feel a definite slowdown.

When your speed has been reduced to approximately five mph below your “safe” speed, release the brakes. (This brake application should last for about three seconds.)

When your speed has increased to your “safe” speed, repeat steps 1 and 2.

For example, if your “safe” speed is 40 mph, you would not apply the brakes until your speed reaches 40 mph. You now apply the brakes hard enough to gradually reduce your speed to 35 mph and then release the brakes. Repeat this as often as necessary until you have reached the end of the downgrade.

Escape ramps have been built on many steep mountain downgrades. Escape ramps are made to stop runaway vehicles safely without injuring drivers and passengers. Escape ramps use a long bed of loose, soft material to slow a runaway vehicle, sometimes in combination with an upgrade. Know escape ramp locations on your route. Signs show drivers where ramp are located. Escape ramps save lives, equipment and cargo.

Subsections 2.15 and 2.16

Test Your Knowledge

1. What factors determine your selection of a “safe” speed when going down a long, steep downgrade?
2. Why should you be in the proper gear before starting down a hill?
3. Describe the proper braking technique when going down a long, steep downgrade.
4. What type of vehicles can get stuck on a railroad-highway crossing?
5. How long does it take for a typical tractor-trailer unit to clear a double track?

These questions may be on the test. If you can’t answer them all, re-read subsections 2.15 and 2.16.
2.17 – Driving Emergencies

Traffic emergencies occur when two vehicles are about to collide. Vehicle emergencies occur when tires, brakes, or other critical parts fail. Following the safety practices in this manual can help prevent emergencies. But if an emergency does happen, your chances of avoiding a crash depend upon how well you take action. Actions you can take are discussed below.

2.17.1 – Steering to Avoid a Crash

Stopping is not always the safest thing to do in an emergency. When you don’t have enough room to stop, you may have to steer away from what’s ahead. Remember, you can almost always turn to miss an obstacle more quickly than you can stop. (However, top-heavy vehicles and tractors with multiple trailers may flip over.)

Keep Both Hands on the Steering Wheel. In order to turn quickly, you must have a firm grip on the steering wheel with both hands. The best way to have both hands on the wheel, if there is an emergency, is to keep them there all the time.

How to Turn Quickly and Safely. A quick turn can be made safely, if it’s done the right way. Here are some points that safe drivers use:

- Do not apply the brake while you are turning. It’s very easy to lock your wheels while turning. If that happens, you may skid out of control.
- Do not turn any more than needed to clear whatever is in your way. The more sharply you turn, the greater the chances of a skid or rollover.
- Be prepared to “counter-steer,” that is, to turn the wheel back in the other direction, once you’ve passed whatever was in your path. Unless you are prepared to counter-steer, you won’t be able to do it quickly enough.
- You should think of emergency steering and counter-steering as two parts of one driving action.

Where to Steer. If an oncoming driver has drifted into your lane, a move to your right is best. If that driver realizes what has happened, the natural response will be to return to his or her own lane.

If something is blocking your path, the best direction to steer will depend on the situation.

If you have been using your mirrors, you’ll know which lane is empty and can be safely used.

If the shoulder is clear, going right may be best. No one is likely to be driving on the shoulder but someone may be passing you on the left. You will know if you have been using your mirrors.

If you are blocked on both sides, a move to the right may be best. At least you won’t force anyone into an opposing traffic lane and a possible head-on collision.

Leaving the Road. In some emergencies, you may have to drive off the road. It may be less risky than facing a collision with another vehicle.

Most shoulders are strong enough to support the weight of a large vehicle and, therefore, offer an available escape route. Here are some guidelines, if you do leave the road.

Avoid Braking. If possible, avoid using the brakes until your speed has dropped to about 20 mph. Then brake very gently to avoid skidding on a loose surface.

Keep One Set of Wheels on the Pavement, if possible. This helps to maintain control.

Stay on the Shoulder. If the shoulder is clear, stay on it until your vehicle has come to a stop. Signal and check your mirrors before pulling back onto the road.

Returning to the Road. If you are forced to return to the road before you can stop, use the following procedure:

Hold the wheel tightly and turn sharply enough to get right back on the road safely. Don’t try to edge gradually back on the road. If you do, your tires might grab unexpectedly and you could lose control.

When both front tires are on the paved surface, counter-steer immediately. The two turns should be made as a single “steer-counter-steer” move.

2.17.2 – How to Stop Quickly and Safely

If somebody suddenly pulls out in front of you, your natural response is to hit the brakes. This is a good response if there’s enough distance to stop, and you use the brakes correctly.

You should brake in a way that will keep your vehicle in a straight line and allow you to turn if it becomes necessary. You can use the “controlled braking” method or the “stab braking” method.

Controlled Braking. With this method, you apply the brakes as hard as you can without locking the wheels. Keep steering wheel movements very small while doing this. If you need to make a larger steering adjustment or if the wheels lock, release the brakes. Re-apply the brakes as soon as you can.

Stab Braking. With this method, you apply your brakes all the way and release brakes when wheels lock up. As soon as the wheels start rolling, apply the brakes fully again. (It can take up to one second for the wheels to start rolling after you release the brakes. If you re-apply the brakes before the wheels start rolling, the vehicle won’t straighten out.)

Don't Jam on the Brakes. Emergency braking does not mean pushing down on the brake pedal as hard as you can. That will only keep the wheels locked up and cause a skid. If the wheels are skidding, you cannot control the vehicle.
2.17.3 – Brake Failure

Brakes kept in good condition rarely fail. Most hydraulic brake failures occur for one of two reasons (Air brakes are discussed in Section 5):

- Loss of hydraulic pressure.
- Brake fade on long hills.

**Loss of Hydraulic Pressure.** When the system won’t build up pressure, the brake pedal will feel spongy or go to the floor. Here are some things you can do.

**Downshift.** Putting the vehicle into a lower gear will help to slow the vehicle.

**Pump the Brakes.** Sometimes pumping the brake pedal will generate enough hydraulic pressure to stop the vehicle.

**Use the Parking Brake.** The parking or emergency brake is separate from the hydraulic brake system. Therefore, it can be used to slow the vehicle. However, be sure to press the release button or pull the release lever at the same time you use the emergency brake so you can adjust the brake pressure and keep the wheels from locking up.

**Find an Escape Route.** While slowing the vehicle, look for an escape route--an open field, side-street, or escape ramp. Turning uphill is a good way to slow and stop the vehicle. Make sure the vehicle does not start rolling backward after you stop. Put it in low gear, apply the parking brake, and, if necessary, roll back into some obstacle that will stop the vehicle.

**Brake Failure on Downgrades.** Going slow enough and braking properly will almost always prevent brake failure on long downgrades. Once the brakes have failed, however, you are going to have to look outside your vehicle for something to stop it.

**Your best hope is an escape ramp.** If there is one, there’ll be signs telling you about it. Use it. Ramps are usually located a few miles from the top of the downgrade. Every year, hundreds of drivers avoid injury to themselves or damage to their vehicles by using escape ramps. Some escape ramps use soft gravel that resists the motion of the vehicle and brings it to a stop. Others turn uphill, using the hill to stop the vehicle and soft gravel to hold it in place.

Any driver who loses brakes going downhill should use an escape ramp if it’s available. If you don’t use it, your chances of having a serious crash may be much greater. If no escape ramp is available, take the least hazardous escape route you can--such as an open field or a side road that flattens out or turns uphill. Make the move as soon as you know your brakes don’t work. The longer you wait, the faster the vehicle will go, and the harder it will be to stop.

2.17.4 – Tire Failure

**Recognize Tire Failure.** Quickly knowing you have a tire failure will let you have more time to react. Having just a few extra seconds to remember what it is you’re supposed to do can help you. The major signs of tire failure are:

- **Sound.** The loud “bang” of a blowout is an easily recognized sign. Because it can take a few seconds for your vehicle to react, you might think it was some other vehicle. But any time you hear a tire blow, you’d be safest to assume it is yours.
- **Vibration.** If the vehicle thumps or vibrates heavily, it may be a sign that one of the tires has gone flat. With a rear tire, that may be the only sign you get.
- **Feel.** If the steering feels “heavy,” it is probably a sign that one of the front tires has failed. Sometimes, failure of a rear tire will cause the vehicle to slide back and forth or “fishtail.” However, dual rear tires usually prevent this.

**Respond to Tire Failure.** When a tire fails, your vehicle is in danger. You must immediately:

- **Hold the Steering Wheel Firmly.** If a front tire fails, it can twist the steering wheel out of your hand. The only way to prevent this is to keep a firm grip on the steering wheel with both hands at all times.
- **Stay off the Brake.** It’s natural to want to brake in an emergency. However, braking when a tire has failed could cause loss of control. Unless you’re about to run into something, stay off the brake until the vehicle has slowed down. Then brake very gently, pull off the road, and stop.
- **Check the Tires.** After you’ve come to a stop, get out and check all the tires. Do this even if the vehicle seems to be handling all right. If one of your dual tires goes, the only way you may know it is by getting out and looking at it.

2.18 – Antilock Braking Systems (ABS)

ABS is a computerized system that keeps your wheels from locking up during hard brake applications.

ABS is an addition to your normal brakes. It does not decrease or increase your normal braking capability. ABS only activates when wheels are about to lock up.

ABS does not necessarily shorten your stopping distance, but it does help you keep the vehicle under control during hard braking.
2.18.1 – How Antilock Braking Systems Work

Sensors detect potential wheel lock up. An electronic control unit (ECU) will then decrease brake pressure to avoid wheel lockup.

Brake pressure is adjusted to provide the maximum braking without danger of lockup.

ABS works far faster than the driver can respond to potential wheel lockup. At all other times the brake system will operate normally.

2.18.2 – Vehicles Required to Have Antilock Braking Systems

The Department of Transportation requires that ABS be on:

- Truck tractors with air brakes built on or after March 1, 1997.
- Other air brake vehicles, (trucks, buses, trailers, and converter dollies) built on or after March 1, 1998.
- Hydraulically braked trucks and buses with a gross vehicle weight rating of 10,000 lbs or more built on or after March 1, 1999.

Many commercial vehicles built before these dates have been voluntarily equipped with ABS.

2.18.3 – How to Know If Your Vehicle Is Equipped with ABS

Tractors, trucks, and buses will have yellow ABS malfunction lamps on the instrument panel.

Trailers will have yellow ABS malfunction lamps on the left side, either on the front or rear corner.

Dollies manufactured on or after March 1, 1998 are required to have a lamp on the left side.

As a system check on newer vehicles, the malfunction lamp comes on at start-up for a bulb check, and then goes out quickly. On older systems, the lamp could stay on until you are driving over five mph.

If the lamp stays on after the bulb check, or goes on once you are under way, you may have lost ABS control.

In the case of towed units manufactured before it was required by the Department of Transportation, it may be difficult to tell if the unit is equipped with ABS. Look under the vehicle for the ECU and wheel speed sensor wires coming from the back of the brakes.

2.18.4 – How ABS Helps You

When you brake hard on slippery surfaces in a vehicle without ABS, your wheels may lock up. When your steering wheels lock up, you lose steering control. When your other wheels lock up, you may skid, jackknife, or even spin the vehicle.

ABS helps you avoid wheel lock up and maintain control. You may or may not be able to stop faster with ABS, but you should be able to steer around an obstacle while braking, and avoid skids caused by over braking.

2.18.5 – ABS on the Tractor Only or Only on the Trailer

Having ABS on only the tractor, only the trailer, or even on only one axle, still gives you more control over the vehicle during braking. Brake normally.

When only the tractor has ABS, you should be able to maintain steering control, and there is less chance of jackknifing. But keep your eye on the trailer and let up on the brakes (if you can safely do so) if it begins to swing out.

When only the trailer has ABS, the trailer is less likely to swing out, but if you lose steering control or start a tractor jackknife, let up on the brakes (if you can safely do so) until you regain control.

2.18.6 – Braking with ABS

When you drive a vehicle with ABS, you should brake as you always have. In other words:

- Use only the braking force necessary to stop safely and stay in control.
- Brake the same way, regardless of whether you have ABS on the bus, tractor, the trailer, or both.
- As you slow down, monitor your tractor and trailer and back off the brakes (if it is safe to do so) to stay in control.

There is only one exception to this procedure. If you drive a straight truck or combination with working ABS on all axles, in an emergency stop, you can fully apply the brakes.

2.18.7 – Braking If ABS Is Not Working

Without ABS you still have normal brake functions. Drive and brake as you always have.

Vehicles with ABS have yellow malfunction lamps to tell you if something isn’t working.

As a system check on newer vehicles, the malfunction lamp comes on at start-up for a bulb check and then goes out quickly. On older systems, the lamp could stay on until you are driving over five mph.

If the lamp stays on after the bulb check, or goes on once you are under way, you may have lost ABS control on one or more wheels.

Remember, if your ABS malfunctions, you still have regular brakes. Drive normally, but get the system serviced soon.
### 2.18.8 – Safety Reminders

ABS won’t allow you to drive faster, follow more closely, or drive less carefully.

ABS won’t prevent power or turning skids—ABS should prevent brake-induced skids or jackknifes, but not those caused by spinning the drive wheels or going too fast in a turn.

ABS won’t necessarily shorten stopping distance. ABS will help maintain vehicle control, but not always shorten stopping distance.

ABS won’t increase or decrease ultimate stopping power – ABS is an “add-on” to your normal brakes, not a replacement for them.

ABS won’t change the way you normally brake. Under normal brake conditions, your vehicle will stop as it always stopped. ABS only comes into play when a wheel would normally have locked up because of over braking.

ABS won’t compensate for bad brakes or poor brake maintenance.

**Remember:** The best vehicle safety feature is still a safe driver.

**Remember:** Drive so you never need to use your ABS.

**Remember:** If you need it, ABS could help to prevent a serious crash.

### 2.19 – Skid Control and Recovery

A skid happens whenever the tires lose their grip on the road. This is caused in one of four ways:

- **Over-braking.** Braking too hard and locking up the wheels. Skids also can occur when using the speed retarder when the road is slippery.

- **Over-steering.** Turning the wheels more sharply than the vehicle can turn.

- **Over-acceleration.** Supplying too much power to the drive wheels, causing them to spin.

- **Driving Too Fast.** Most serious skids result from driving too fast for road conditions. Drivers who adjust their driving to conditions don’t over-accelerate and don’t have to over-brake or over-steer from too much speed.

#### 2.19.1 – Drive-wheel Skids

By far the most common skid is one in which the rear wheels lose traction through excessive braking or acceleration. Skids caused by acceleration usually happen on ice or snow. Taking your foot off the accelerator can easily stop them. (If it is very slippery, push the clutch in. Otherwise, the engine can keep the wheels from rolling freely and regaining traction).

Rear wheel braking skids occur when the rear drive wheels lock. Because locked wheels have less traction than rolling wheels, the rear wheels usually slide sideways in an attempt to “catch up” with the front wheels. In a bus or straight truck, the vehicle will slide sideways in a “spin out.” With vehicles towing trailers, a drive-wheel skid can let the trailer push the towing vehicle sideways, causing a sudden jackknife. See Figure 2.19.

#### 2.19.2 – Correcting a Drive-wheel Braking Skid

Do the following to correct a drive-wheel braking skid:

- **Stop Braking.** This will let the rear wheels roll again, and keep the rear wheels from sliding.

- **Counter-steer.** As a vehicle turns back on course, it has a tendency to keep on turning. Unless you turn the steering wheel quickly the other way, you may find yourself skidding in the opposite direction.

Learning to stay off the brake, turn the steering wheel quickly, push in the clutch, and counter-steer in a skid takes a lot of practice. The best place to get this practice is on a large driving range or “skid pad.”
2.19.3 – Front-wheel Skids
Driving too fast for conditions causes most front-wheel skids. Other causes include lack of tread on the front tires and cargo loaded so not enough weight is on the front axle. In a front-wheel skid, the front end tends to go in a straight line regardless of how much you turn the steering wheel. On a very slippery surface, you may not be able to steer around a curve or turn.
When a front-wheel skid occurs, the only way to stop the skid is to let the vehicle slow down. Stop turning and/or braking so hard. Slow down as quickly as possible without skidding.

Subsections 2.17, 2.18, and 2.19

Test Your Knowledge
1. Stopping is not always the safest thing to do in an emergency. True or False?
2. What are some advantages of going right instead of left around an obstacle?
3. What is an “escape ramp?”
4. If a tire blows out, you should put the brakes on hard to stop quickly. True or False?
5. How do you know if your vehicle has antilock brakes?
6. What is the proper braking technique when driving a vehicle with antilock brakes?
7. How do antilock brakes help you?

These questions may be on the test. If you can’t answer them all, re-read subsections 2.17, 2.18, and 2.19.

2.20 – Accident Procedures
When you’re in an accident and not seriously hurt, you need to act to prevent further damage or injury. The basic steps to be taken at any accident are to:
- Protect the area.
- Notify authorities.
- Care for the injured.

2.20.1 – Protect the Area
The first thing to do at an accident scene is to keep another accident from happening in the same spot. To protect the accident area:
- If your vehicle is involved in the accident, try to get it to the side of the road. This will help prevent another accident and allow traffic to move.
- If you’re stopping to help, park away from the accident. The area immediately around the accident will be needed for emergency vehicles.
- Put on your flashers.
- Set out reflective triangles to warn other traffic. Make sure other drivers can see them in time to avoid the accident.

2.20.2 – Notify Authorities
If you have a cell phone or CB, call for assistance before you get out of your vehicle. If not, wait until after the accident scene has been properly protected, then phone or send someone to phone the police. Try to determine where you are so you can give the exact location.

2.20.3 – Care for the Injured
If a qualified person is at the accident and helping the injured, stay out of the way unless asked to assist. Otherwise, do the best you can to help any injured parties. Here are some simple steps to follow in giving assistance:
- Don’t move a severely injured person unless the danger of fire or passing traffic makes it necessary.
- Stop heavy bleeding by applying direct pressure to the wound.
- Keep the injured person warm.
2.21 – Fires
Truck fires can cause damage and injury. Learn the causes of fires and how to prevent them. Know what to do to extinguish fires.

2.21.1 – Causes of Fire
The following are some causes of vehicle fires:

- **After Accidents.** Spilled fuel, improper use of flares.
- **Tires.** Under-inflated tires and duals that touch.
- **Electrical System.** Short circuits due to damaged insulation, loose connections.
- **Fuel.** Driver smoking, improper fueling, loose fuel connections.
- **Cargo.** Flammable cargo, improperly sealed or loaded cargo, poor ventilation.

2.21.2 – Fire Prevention
Pay attention to the following:

- **Vehicle Inspection.** Make a complete inspection of the electrical, fuel, and exhaust systems, tires, and cargo. Be sure to check that the fire extinguisher is charged.
- **En Route Inspection.** Check the tires, wheels, and truck body for signs of heat whenever you stop during a trip.
- **Follow Safe Procedures.** Follow correct safety procedures for fueling the vehicle, using brakes, handling flares, and other activities that can cause a fire.
- **Monitoring.** Check the instruments and gauges often for signs of overheating and use the mirrors to look for signs of smoke from tires or the vehicle.
- **Caution.** Use normal caution in handling anything flammable.

2.21.3 – Fire Fighting
Knowing how to fight fires is important. Drivers who didn’t know what to do have made fires worse. Know how the fire extinguisher works. Study the instructions printed on the extinguisher before you need it. Here are some procedures to follow in case of fire.

- **Pull Off the Road.** The first step is to get the vehicle off the road and stop. In doing so:
  - Park in an open area, away from buildings, trees, brush, other vehicles, or anything that might catch fire.
  - Don’t pull into a service station!
  - Notify emergency services of your problem and your location.

With an engine fire, turn off the engine as soon as you can. Don’t open the hood if you can avoid it. Shoot foam through louvers, radiator, or from the vehicle’s underside.

- **Extinguish the Fire.** Here are some rules to follow in putting out a fire:
  - When using the extinguisher, stay as far away from the fire as possible.
  - Aim at the source or base of the fire, not up in the flames.

**Use the Right Fire Extinguisher**
Figures 2.20 and 2.21 detail the type of fire extinguisher to use by class of fire.

- **The B:C type fire extinguisher is designed to work on electrical fires and burning liquids.**
- **The A:B:C type is designed to work on burning wood, paper, and cloth as well.**
- **Water can be used on wood, paper, or cloth, but don’t use water on an electrical fire (can cause shock) or a gasoline fire (it will spread the flames).**
- **A burning tire must be cooled. Lots of water may be required.**
- **If you’re not sure what to use, especially on a hazardous materials fire, wait for firefighters.**
- **Position yourself upwind. Let the wind carry the extinguisher to the fire.**
- **Continue until whatever was burning has been cooled. Absence of smoke or flame does not mean the fire cannot restart.**

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Wood, Paper, Ordinary Combustibles</td>
</tr>
<tr>
<td></td>
<td>Extinguish by cooling and quenching using water or dry chemicals.</td>
</tr>
<tr>
<td>B</td>
<td>Gasoline, Oil, Grease, Other Greasy Liquids</td>
</tr>
<tr>
<td></td>
<td>Extinguish by smothering, cooling or heat shielding using carbon dioxide or dry chemicals.</td>
</tr>
<tr>
<td>C</td>
<td>Electrical Equipment Fires</td>
</tr>
<tr>
<td></td>
<td>Extinguish with non-conducting agents such as carbon dioxide or dry chemicals. Do not use water.</td>
</tr>
<tr>
<td>D</td>
<td>Fires in Combustible Metals</td>
</tr>
<tr>
<td></td>
<td>Extinguish by using specialized extinguishing powders.</td>
</tr>
</tbody>
</table>

*Figure 2.20*
**Class of Fire/Type of Extinguisher**

<table>
<thead>
<tr>
<th>Class of Fire</th>
<th>Fire Extinguisher Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>B or C</td>
<td>Regular Dry Chemical</td>
</tr>
<tr>
<td>A, B, C or D</td>
<td>Multi Purpose Dry Chemical</td>
</tr>
<tr>
<td>D</td>
<td>Purple K Dry Chemical</td>
</tr>
<tr>
<td>B or C</td>
<td>KCL Dry Chemical</td>
</tr>
<tr>
<td>D</td>
<td>Dry Powder Special Compound</td>
</tr>
<tr>
<td>B or C</td>
<td>Carbon Dioxide (Dry)</td>
</tr>
<tr>
<td>B or C</td>
<td>Halogenated Agent (Gas)</td>
</tr>
<tr>
<td>A</td>
<td>Water</td>
</tr>
<tr>
<td>A</td>
<td>Water With Anti-Freeze</td>
</tr>
<tr>
<td>A or B</td>
<td>Water, Loaded Steam Style</td>
</tr>
<tr>
<td>B, on some A</td>
<td>Foam</td>
</tr>
</tbody>
</table>

**Figure 2.21**

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**2.22 – Alcohol, Other Drugs, and Driving**

**2.22.1 – Alcohol and Driving**

Drinking alcohol and then driving is very dangerous and a serious problem. People who drink alcohol are involved in traffic accidents resulting in over 20,000 deaths every year. Alcohol impairs muscle coordination, reaction time, depth perception, and night vision. It also affects the parts of the brain that control judgment and inhibition. For some people, one drink is all it takes to show signs of impairment.

**What Is a Drink?**

It is the alcohol in drinks that affects human performance. It doesn’t make any difference whether that alcohol comes from “a couple of beers,” or from two glasses of wine, or two shots of hard liquor. Approximate Blood Alcohol Content.

<table>
<thead>
<tr>
<th>Drinks</th>
<th>Body Weight in Pounds</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>0</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>1</td>
<td>.04</td>
<td>.03</td>
</tr>
<tr>
<td>2</td>
<td>.08</td>
<td>.06</td>
</tr>
<tr>
<td>3</td>
<td>.11</td>
<td>.09</td>
</tr>
<tr>
<td>4</td>
<td>.15</td>
<td>.12</td>
</tr>
<tr>
<td>5</td>
<td>.19</td>
<td>.16</td>
</tr>
<tr>
<td>6</td>
<td>.23</td>
<td>.19</td>
</tr>
<tr>
<td>7</td>
<td>.26</td>
<td>.22</td>
</tr>
<tr>
<td>9</td>
<td>.34</td>
<td>.28</td>
</tr>
<tr>
<td>10</td>
<td>.38</td>
<td>.31</td>
</tr>
</tbody>
</table>

Subtract .01% for each 40 minutes of drinking. One drink is 1.25 oz. of 80 proof liquor, 12 oz. of beer, or 5 oz. of table wine.

**Figure 2.22**

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**Subsections 2.20 and 2.21**

**Test Your Knowledge**

1. What are some things to do at an accident scene to prevent another accident?
2. Name two causes of tire fires.
3. What kinds of fires is a B:C extinguisher not good for?
4. When using your extinguisher, should you get as close as possible to the fire?
5. Name some causes of vehicle fires.

These questions may be on the test. If you can’t answer them all, re-read subsections 2.20 and 2.21.
How Alcohol Works. Alcohol goes directly into the blood stream and is carried to the brain. After passing through the brain, a small percentage is removed in urine, perspiration, and by breathing, while the rest is carried to the liver.

The liver can only process one-third an ounce of alcohol per hour, which is considerably less than the alcohol in a standard drink. This is a fixed rate, so only time, not black coffee or a cold shower, will sober you up. If you have drinks faster than your body can get rid of them, you will have more alcohol in your body, and your driving will be more affected. The Blood Alcohol Concentration (BAC) commonly measures the amount of alcohol in your body. See Figure 2.22.

All of the following drinks contain the same amount of alcohol:

- A 12-ounce glass of 5% beer.
- A 5-ounce glass of 12% wine.
- A 1 1/2-ounce shot of 80 proof liquor.

What Determines Blood Alcohol Concentration? BAC is determined by the amount of alcohol you drink (more alcohol means higher BAC), how fast you drink (faster drinking means higher BAC), and your weight (a small person doesn't have to drink as much to reach the same BAC).

Alcohol and the Brain. Alcohol affects more and more of the brain as BAC builds up. The first part of the brain affected controls judgment and self-control. One of the bad things about this is it can keep drinkers from knowing they are getting drunk. And, of course, good judgment and self-control are absolutely necessary for safe driving.

As BAC continues to build up, muscle control, vision, and coordination are affected more and more. Effects on driving may include:

- Straddling lanes.
- Quick, jerky starts.
- Not signaling, failure to use lights.
- Running stop signs and red lights.
- Improper passing (See Figure 2.23).

These effects mean increased chances of a crash and chances of losing your driver’s license. Accident statistics show that the chance of a crash is much greater for drivers who have been drinking than for drivers who have not.

How Alcohol Affects Driving. All drivers are affected by drinking alcohol. Alcohol affects judgment, vision, coordination, and reaction time. It causes serious driving errors, such as:

- Increased reaction time to hazards.
- Driving too fast or too slow.
- Driving in the wrong lane.
- Running over the curb.
- Weaving.

### Effects of Increasing Blood Alcohol Content

<table>
<thead>
<tr>
<th>BAC</th>
<th>Effects on Body</th>
<th>Effects on Driving Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>.02</td>
<td>Mellow feeling, slight body warmth.</td>
<td>Less inhibited.</td>
</tr>
<tr>
<td>.05</td>
<td>Noticeable relaxation.</td>
<td>Less alert, less self-focused, coordination impairment begins.</td>
</tr>
<tr>
<td>.08</td>
<td>Definite impairment in coordination and judgment.</td>
<td>Drunk driving limit, impaired coordination and judgment.</td>
</tr>
<tr>
<td>.10*</td>
<td>Noisy, possible embarrassing behavior, mood swings.</td>
<td>Reduction in reaction time.</td>
</tr>
<tr>
<td>.15</td>
<td>Impaired balance and movement, clearly drunk.</td>
<td>Unable to drive.</td>
</tr>
<tr>
<td>.30</td>
<td>Many lose consciousness.</td>
<td></td>
</tr>
<tr>
<td>.40</td>
<td>Most lose consciousness, some die.</td>
<td></td>
</tr>
<tr>
<td>.50</td>
<td>Breathing stops, many die.</td>
<td></td>
</tr>
</tbody>
</table>

BAC of .10 means that 1/10 of 1% (or 1/1000) of your total blood content is alcohol.

2.22.2 – Other Drugs

Besides alcohol, other legal and illegal drugs are being used more often. Laws prohibit possession or use of many drugs while on duty. They prohibit being under the influence of any “controlled substance,” amphetamines (including “pep pills,” “uppers,” and “bennies”), narcotics, or any other substance, which can make the driver unsafe. This could include a variety of prescription and over-the-counter drugs (cold medicines), which may make the driver drowsy or otherwise affect safe driving ability. However, possession and use of a drug given to a driver by a doctor is permitted if the doctor informs the driver that it will not affect safe driving ability.

Pay attention to warning labels for legitimate drugs and medicines, and to doctor’s orders regarding possible effects. Stay away from illegal drugs.

Don’t use any drug that hides fatigue—the only cure for fatigue is rest. Alcohol can make the effects of other drugs much worse. The safest rule is don’t mix drugs with driving at all.

Use of drugs can lead to traffic accidents resulting in death, injury, and property damage. Furthermore, it can lead to arrest, fines, and jail sentences. It can also mean the end of a person’s driving career.
2.22.3 – Illness
Once in a while, you may become so ill that you cannot operate a motor vehicle safely. If this happens to you, you must not drive. However, in case of an emergency, you may drive to the nearest place where you can safely stop.

2.23 – Hazardous Materials Rules For All Commercial Drivers
All drivers should know something about hazardous materials. You must be able to recognize hazardous cargo, and you must know whether or not you can haul it without having a hazardous materials endorsement on your CDL license.

2.23.1 – What Are Hazardous Materials?
Hazardous materials are products that pose a risk to health, safety, and property during transportation. See Figure 2.24.

2.23.2 – Why Are There Rules?
You must follow the many rules about transporting hazardous materials. The intent of the rules is to:
- Contain the product.
- Communicate the risk.
- Ensure safe drivers and equipment.

To Contain the Product. Many hazardous products can injure or kill on contact. To protect drivers and others from contact, the rules tell shippers how to package safely. Similar rules tell drivers how to load, transport, and unload bulk tanks. These are containment rules.

To Communicate the Risk. The shipper uses a shipping paper and diamond shaped hazard labels to warn dockworkers and drivers of the risk.

After an accident or hazardous material spill or leak, you may be injured and unable to communicate the hazards of the materials you are transporting. Firefighters and police can prevent or reduce the amount of damage or injury at the scene if they know what hazardous materials are being transported. Your life, and the lives of others, may depend on quickly locating the hazardous materials shipping papers. For that reason, you must identify shipping papers related to hazardous materials or keep them on top of other shipping papers. You must also keep shipping papers:
- In a pouch on the driver’s door, or
- In clear view within reach while driving, or
- On the driver’s seat when out of the vehicle.

### Hazard Class Definitions

<table>
<thead>
<tr>
<th>Class</th>
<th>Class Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Explosives</td>
<td>Ammunition, Dynamite, Fireworks</td>
</tr>
<tr>
<td>2</td>
<td>Gases</td>
<td>Propane, Oxygen, Helium</td>
</tr>
<tr>
<td>3</td>
<td>Flammable</td>
<td>Gasoline Fuel, Acetone</td>
</tr>
<tr>
<td>4</td>
<td>Flammable Solids</td>
<td>Matches, Fuses</td>
</tr>
<tr>
<td>5</td>
<td>Oxidizers</td>
<td>Ammonium Nitrate, Hydrogen Peroxide</td>
</tr>
<tr>
<td>6</td>
<td>Poisons</td>
<td>Pesticides, Arsenic</td>
</tr>
<tr>
<td>7</td>
<td>Radioactive</td>
<td>Uranium, Plutonium</td>
</tr>
<tr>
<td>8</td>
<td>Corrosives</td>
<td>Hydrochloric Acid, Battery Acid</td>
</tr>
<tr>
<td>9</td>
<td>Miscellaneous Hazardous Materials</td>
<td>Formaldehyde, Asbestos</td>
</tr>
<tr>
<td>None</td>
<td>ORM-D (Other Regulated Material-Domestic)</td>
<td>Hair Spray or Charcoal</td>
</tr>
<tr>
<td>None</td>
<td>Combustible Liquids</td>
<td>Fuel Oils, Lighter Fluid</td>
</tr>
</tbody>
</table>

*Figure 2.24*
2.23.3 – Lists of Regulated Products

Placards are used to warn others of hazardous materials. Placards are signs put on the outside of a vehicle that identify the hazard class of the cargo. A placarded vehicle must have at least four identical placards. They are put on the front, rear, and both sides. Placards must be readable from all four directions. They must be at least $10 \frac{3}{4}$ inches square, turned upright on a point, in a diamond shape. Cargo tanks and other bulk packaging display the identification number of their contents on placards or orange panels.

Identification Numbers are a four digit code used by first responders to identify hazardous materials. An identification number may be used to identify more than one chemical on shipping papers. The identification number will be preceded by the letters “NA” or “UN”. The US DOT Emergency Response Guidebook (ERG) lists the chemicals and the identification numbers assigned to them.

Not all vehicles carrying hazardous materials need to have placards. The rules about placards are given in Section 9 of this manual. You can drive a vehicle that carries hazardous materials if it does not require placards. If it requires placards, you cannot drive it unless your driver license has the hazardous materials endorsement. See Figure 2.25.

The rules require all drivers of placarded vehicles to learn how to safely load and transport hazardous products. They must have a commercial driver license with the hazardous materials endorsement. To get the required endorsement, you must pass a written test on material found in Section 9 of this manual. A tank endorsement is required for any commercial vehicle that is designed to transport any liquid or gaseous materials in a tank or tanks having an individual rated capacity of more than 119 gallons and an aggregate capacity of 1,000 gallons or more that is either permanently or temporarily attached to the vehicle or chassis. The liquid or gas does not have to be a hazardous material.

Drivers who need the hazardous materials endorsement must learn the placard rules. If you do not know if your vehicle needs placards, ask your employer. Never drive a vehicle needing placards unless you have the hazardous materials endorsement. To do so is a crime. When stopped, you will be cited and you will not be allowed to drive your truck. It will cost you time and money. A failure to placard when needed may risk your life and others if you have an accident. Emergency help will not know of your hazardous cargo.

Hazardous materials drivers must also know which products they can load together, and which they cannot. These rules are also in Section 9. Before loading a truck with more than one type of product, you must know if it is safe to load them together. If you do not know, ask your employer and consult the regulations.

Subsections 2.22 and 2.23

Test Your Knowledge

1. Common medicines for colds can make you sleepy. True or False?
2. Coffee and a little fresh air will help a drinker sober up. True or False?
3. What is a hazardous materials placard?
4. Why are placards used?

These questions may be on the test. If you can’t answer them all, re-read subsections 2.22 and 2.23.
This section tells you about air brakes. If you want to drive a truck or bus with air brakes, or pull a trailer with air brakes, you need to read this section. If you want to pull a trailer with air brakes, you also need to read Section 6, Combination Vehicles.

Air brakes use compressed air to make the brakes work. Air brakes are a good and safe way of stopping large and heavy vehicles, but the brakes must be well maintained and used properly.

Air brakes are really three different braking systems: service brake, parking brake, and emergency brake.

The service brake system applies and releases the brakes when you use the brake pedal during normal driving.

The parking brake system applies and releases the parking brakes when you use the parking brake control.

The emergency brake system uses parts of the service and parking brake systems to stop the vehicle in a brake system failure.

The parts of these systems are discussed in greater detail below.

5.1 – The Parts of an Air Brake System

There are many parts to an air brake system. You should know about the parts discussed here.

5.1.1 – Air Compressor

The air compressor pumps air into the air storage tanks (reservoirs). The air compressor is connected to the engine through gears or a v-belt. The compressor may be air cooled or may be cooled by the engine cooling system. It may have its own oil supply or be lubricated by engine oil. If the compressor has its own oil supply, check the oil level before driving.

5.1.2 – Air Compressor Governor

The governor controls when the air compressor will pump air into the air storage tanks. When air tank pressure rises to the “cut-out” level (around 125 pounds per-square-inch or “psi”), the governor stops the compressor from pumping air. When the tank pressure falls to the “cut-in” pressure (around 100 psi), the governor allows the compressor to start pumping again.

5.1.3 – Air Storage Tanks

Air storage tanks are used to hold compressed air. The number and size of air tanks varies among vehicles. The tanks will hold enough air to allow the brakes to be used several times, even if the compressor stops working.

5.1.4 – Air Tank Drains

Compressed air usually has some water and some compressor oil in it, which is bad for the air brake system. For example, the water can freeze in cold weather and cause brake failure. The water and oil tend to collect in the bottom of the air tank. Be sure that you drain the air tanks completely. Each air tank is equipped with a drain valve in the bottom. There are two types:

Manually operated by turning a quarter turn or by pulling a cable. You must drain the tanks yourself at the end of each day of driving. See Figure 5.1.

Automatic. The water and oil are automatically expelled. These tanks may be equipped for manual draining as well.

Automatic air tanks are available with electric heating devices. These help prevent freezing of the automatic drain in cold weather.
5.1.5 – Alcohol Evaporator
Some air brake systems have an alcohol evaporator to put alcohol into the air system. This helps to reduce the risk of ice in air brake valves and other parts during cold weather. Ice inside the system can make the brakes stop working.
Check the alcohol container and fill up as necessary, every day during cold weather. Daily air tank drainage is still needed to get rid of water and oil. (Unless the system has automatic drain valves.)

5.1.6 – Safety Valve
A safety relief valve is installed in the first tank the air compressor pumps air to. The safety valve protects the tank and the rest of the system from too much pressure. The valve is usually set to open at 150 psi. If the safety valve releases air, something is wrong. Have the fault fixed by a mechanic.

5.1.7 – The Brake Pedal
You put on the brakes by pushing down the brake pedal. (It is also called the foot valve or treadle valve.) Pushing the pedal down harder applies more air pressure. Letting up on the brake pedal reduces the air pressure and releases the brakes. Releasing the brakes lets some compressed air go out of the system, so the air pressure in the tanks is reduced. It must be made up by the air compressor.
Pressing and releasing the pedal unnecessarily can let air out faster than the compressor can replace it. If the pressure gets too low, the brakes won’t work.

5.1.8 – Foundation Brakes
Foundation brakes are used at each wheel. The most common type is the s-cam drum brake. The parts of the brake are discussed below.

Brake Drums, Shoes, and Linings. Brake drums are located on each end of the vehicle’s axles. The wheels are bolted to the drums. The braking mechanism is inside the drum. To stop, the brake shoes and linings are pushed against the inside of the drum. This causes friction, which slows the vehicle (and creates heat). The heat a drum can take without damage depends on how hard and how long the brakes are used. Too much heat can make the brakes stop working.

S-cam Brakes. When you push the brake pedal, air is let into each brake chamber. Air pressure pushes the rod out, moving the slack adjuster, thus twisting the brake camshaft. This turns the s-cam (so called because it is shaped like the letter “S”). The s-cam forces the brake shoes away from one another and presses them against the inside of the brake drum.

When you release the brake pedal, the s-cam rotates back and a spring pulls the brake shoes away from the drum, letting the wheels roll freely again. See Figure 5.2.

Drum Brake

Wedge Brakes. In this type of brake, the brake chamber push rod pushes a wedge directly between the ends of two brake shoes. This shoves them apart and against the inside of the brake drum. Wedge brakes may have a single brake chamber, or two brake chambers, pushing wedges in at both ends of the brake shoes. Wedge type brakes may be self-adjusting or may require manual adjustment.

Disc Brakes. In air-operated disc brakes, air pressure acts on a brake chamber and slack adjuster, like s-cam brakes. But instead of the s-cam, a “power screw” is used. The pressure of the brake chamber on the slack adjuster turns the power screw. The power screw clamps the disc or rotor between the brake lining pads of a caliper, similar to a large c-clamp.
Wedge brakes and disc brakes are less common than s-cam brakes.

5.1.9 – Supply Pressure Gauges
All vehicles with air brakes have a pressure gauge connected to the air tank. If the vehicle has a dual air brake system, there will be a gauge for each half of the system. (Or a single gauge with two needles.) Dual systems will be discussed later. These gauges tell you how much pressure is in the air tanks.
5.1.10 – Application Pressure Gauge
This gauge shows how much air pressure you are applying to the brakes (this gauge is not on all vehicles). Increasing application pressure to hold the same speed means the brakes are fading. You should slow down and use a lower gear. The need for increased pressure can also be caused by brakes out of adjustment, air leaks, or mechanical problems.

5.1.11 – Low Air Pressure Warning
A low air pressure warning signal is required on vehicles with air brakes. A warning signal you can see must come on before the air pressure in the tanks falls below 60 psi. (Or one half the compressor governor cutout pressure on older vehicles.) The warning is usually a red light. A buzzer may also come on.

Another type of warning is the “wig wag.” This device drops a mechanical arm into your view when the pressure in the system drops below 60 psi. An automatic wig wag will rise out of your view when the pressure in the system goes above 60 psi. The manual reset type must be placed in the “out of view” position manually. It will not stay in place until the pressure in the system is above 60 psi.

On large buses it is common for the low pressure warning devices to signal at 80-85 psi.

5.1.12 – Stop Light Switch
Drivers behind you must be warned when you put your brakes on. The air brake system does this with an electric switch that works by air pressure. The switch turns on the brake lights when you put on the air brakes.

5.1.13 – Front Brake Limiting Valve
Some older vehicles (made before 1975) have a front brake limiting valve and a control in the cab. The control is usually marked “normal” and “slippery.” When you put the control in the “slippery” position, the limiting valve cuts the “normal” air pressure to the front brakes by half. Limiting valves were used to reduce the chance of the front wheels skidding on slippery surfaces. However, they actually reduce the stopping power of the vehicle. Front wheel braking is good under all conditions. Tests have shown front wheel skids from braking are not likely even on ice. Make sure the control is in the “normal” position to have normal stopping power.

Many vehicles have automatic front wheel limiting valves. They reduce the air to the front brakes except when the brakes are put on very hard (60 psi or more application pressure). These valves cannot be controlled by the driver.

5.1.14 – Spring Brakes
All trucks, truck tractors, and buses must be equipped with emergency brakes and parking brakes. They must be held on by mechanical force (because air pressure can eventually leak away). Spring brakes are usually used to meet these needs. When driving, powerful springs are held back by air pressure. If the air pressure is removed, the springs put on the brakes. A parking brake control in the cab allows the driver to let the air out of the spring brakes. This lets the springs put the brakes on. A leak in the air brake system, which causes all the air to be lost, will also cause the springs to put on the brakes.

Tractor and straight truck spring brakes will come fully on when air pressure drops to a range of 20 to 45 psi (typically 20 to 30 psi). Do not wait for the brakes to come on automatically. When the low air pressure warning light and buzzer first come on, bring the vehicle to a safe stop right away, while you can still control the brakes.

The braking power of spring brakes depends on the brakes being in adjustment. If the brakes are not adjusted properly, neither the regular brakes nor the emergency/parking brakes will work right.

5.1.15 – Parking Brake Controls
In newer vehicles with air brakes, you put on the parking brakes using a diamond-shaped, yellow, push-pull control knob. You pull the knob out to put the parking brakes (spring brakes) on, and push it in to release them. On older vehicles, the parking brakes may be controlled by a lever. Use the parking brakes whenever you park.

Caution. Never push the brake pedal down when the spring brakes are on. If you do, the brakes could be damaged by the combined forces of the springs and the air pressure. Many brake systems are designed so this will not happen. But not all systems are set up that way, and those that are may not always work. It is much better to develop the habit of not pushing the brake pedal down when the spring brakes are on.

Modulating Control Valves. In some vehicles a control handle on the dash board may be used to apply the spring brakes gradually. This is called a modulating valve. It is spring-loaded so you have a feel for the braking action. The more you move the control lever, the harder the spring brakes come on. They work this way so you can control the spring brakes if the service brakes fail. When parking a vehicle with a modulating control valve, move the lever as far as it will go and hold it in place with the locking device.
Dual Parking Control Valves. When main air pressure is lost, the spring brakes come on. Some vehicles, such as buses, have a separate air tank which can be used to release the spring brakes. This is so you can move the vehicle in an emergency. One of the valves is a push-pull type and is used to put on the spring brakes for parking. The other valve is spring loaded in the “out” position. When you push the control in, air from the separate air tank releases the spring brakes so you can move. When you release the button, the spring brakes come on again. There is only enough air in the separate tank to do this a few times. Therefore, plan carefully when moving. Otherwise, you may be stopped in a dangerous location when the separate air supply runs out. See Figure 5.3.

**Tractor Protection Valve & Emergency Trailer Brake Operation**

**Tractor protection valve**
- Provides air supply
- Closes automatically if air supply drops when driving

The parking brakes, when applied, close the tractor protection valve and set the spring brakes at the same time.

Tractors, trucks, and buses will have yellow ABS malfunction lamps on the instrument panel.

Trailers will have yellow ABS malfunction lamps on the left side, either on the front or rear corner. Dollies manufactured on or after March 1, 1998 are required to have a lamp on the left side.

On newer vehicles, the malfunction lamp comes on at start-up for a bulb check, and then goes out quickly. On older systems, the lamp could stay on until you are driving over five mph.

If the lamp stays on after the bulb check, or goes on once you are under way, you may have lost ABS control at one or more wheels.

In the case of towed units manufactured before it was required by the Department of Transportation, it may be difficult to tell if the unit is equipped with ABS. Look under the vehicle for the electronic control unit (ECU) and wheel speed sensor wires coming from the back of the brakes.

ABS is an addition to your normal brakes. It does not decrease or increase your normal braking capability. ABS only activates when wheels are about to lock up.

ABS does not necessarily shorten your stopping distance, but it does help you keep the vehicle under control during hard braking.

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Subsection 5.1

**Test Your Knowledge**

1. Why must air tanks be drained?
2. What is a supply pressure gauge used for?
3. All vehicles with air brakes must have a low air pressure warning signal. True or False?
4. What are spring brakes?
5. Front wheel brakes are good under all conditions. True or False?
6. How do you know if your vehicle is equipped with antilock brakes?

These questions may be on your test. If you can’t answer them all, re-read subsection 5.1.
5.2 – Dual Air Brake

Most heavy-duty vehicles use dual air brake systems for safety. A dual air brake system has two separate air brake systems, which use a single set of brake controls. Each system has its own air tanks, hoses, lines, etc. One system typically operates the regular brakes on the rear axle or axles. The other system operates the regular brakes on the front axle (and possibly one rear axle). Both systems supply air to the trailer (if there is one). The first system is called the “primary” system. The other is called the “secondary” system. See Figure 5.4.

Before driving a vehicle with a dual air system, allow time for the air compressor to build up a minimum of 100 psi pressure in both the primary and secondary systems. Watch the primary and secondary air pressure gauges (or needles, if the system has two needles in one gauge). Pay attention to the low air pressure warning light and buzzer. The warning light and buzzer should shut off when air pressure in both systems rises to a value set by the manufacturer. This value must be greater than 60 psi.

The warning light and buzzer should come on before the air pressure drops below 60 psi in either system. If this happens while driving, you should stop right away and safely park the vehicle. If one air system is very low on pressure, either the front or the rear brakes will not be operating fully. This means it will take you longer to stop. Bring the vehicle to a safe stop, and have the air brakes system fixed.

5.3 – Inspecting Air Brake Systems

You should use the basic seven-step inspection procedure described in Section 2 to inspect your vehicle. There are more things to inspect on a vehicle with air brakes than one without them. These things are discussed below, in the order they fit into the seven-step method.

5.3.1 – During Step 2 Engine Compartment Checks

Check Air Compressor Drive Belt (if compressor is belt-driven). If the air compressor is belt-driven, check the condition and tightness of the belt. It should be in good condition.

5.3.2 – During Step 5 Walk-around Inspection

Check Slack Adjusters on S-cam Brakes. Park on level ground and chock the wheels to prevent the vehicle from moving. Release the parking brakes so you can move the slack adjusters. Use gloves and pull hard on each slack adjuster that you can reach. If a slack adjuster moves more than about one inch where the push rod attaches to it, it probably needs adjustment. Adjust it or have it adjusted. Vehicles with too much brake slack can be very hard to stop. Out-of-adjustment brakes are the most common problem found in roadside inspections. Be safe. Check the slack adjusters.
All vehicles built since 1994 have automatic slack adjustors. Even though automatic slack adjustors adjust themselves during full brake applications, they must be checked.

Automatic adjusters should not have to be manually adjusted except when performing maintenance on the brakes and during installation of the slack adjusters. In a vehicle equipped with automatic adjusters, when the pushrod stroke exceeds the legal brake adjustment limit, it is an indication that a mechanical problem exists in the adjuster itself, a problem with the related foundation brake components, or that the adjuster was improperly installed.

The manual adjustment of an automatic adjuster to bring a brake pushrod stroke within legal limits is generally masking a mechanical problem and is not fixing it. Further, routine adjustment of most automatic adjusters will likely result in premature wear of the adjuster itself. It is recommended that when brakes equipped with automatic adjusters are found to be out of adjustment, the driver take the vehicle to a repair facility as soon as possible to have the problem corrected. The manual adjustment of automatic slack adjusters is dangerous because it may give the driver a false sense of security regarding the effectiveness of the braking system.

The manual adjustment of an automatic adjuster should only be used as a temporary measure to correct the adjustment in an emergency situation as it is likely the brake will soon be back out of adjustment since this procedure usually does not fix the underlying adjustment problem.

(Note: Automatic slack adjusters are made by different manufacturers and do not all operate the same. Therefore, the specific manufacturer’s Service Manual should be consulted prior to troubleshooting a brake adjustment problem.)

Check Brake Drums (or Discs), Linings, and Hoses.

Brake drums (or discs) must not have cracks longer than one half the width of the friction area. Linings (friction material) must not be loose or soaked with oil or grease. They must not be dangerously thin. Mechanical parts must be in place, not broken or missing. Check the air hoses connected to the brake chambers to make sure they aren’t cut or worn due to rubbing.

5.3.3 – Step 7 Final Air Brake Check

Do the following checks instead of the hydraulic brake check shown in Section 2, Step 7: Check Brake System.

**Test Low Pressure Warning Signal.** Shut the engine off when you have enough air pressure so that the low pressure warning signal is not on. Turn the electrical power on and step on and off the brake pedal to reduce tank pressure. The low air pressure warning signal must come on before the pressure drops to less than 60 psi in the air tank (or tank with the lowest air pressure, in dual air systems). See Figure 5.5.

If the warning signal doesn’t work, you could lose air pressure and you would not know it. This could cause sudden emergency braking in a single-circuit air system. In dual systems the stopping distance will be increased. Only limited braking can be done before the spring brakes come on.

**Low Air Pressure Warning Devices**

![Low Air Pressure Warning Devices](image)

Some vehicles are equipped with a “Wig-Wag” that drops into the driver’s view, and will not stay up in place until the desired air pressure is restored.

**Check That Spring Brakes Come On Automatically.**

Continue to fan off the air pressure by stepping on and off the brake pedal to reduce tank pressure. The tractor protection valve and parking brake valve should close (pop out) on a tractor-trailer combination vehicle and the parking brake valve should close (pop out) on other combination and single vehicle types when the air pressure falls to the manufacturer’s specification (20 – 45 psi). This will cause the spring brakes to come on.

**Check Rate of Air Pressure Buildup.** When the engine is at operating rpms, the pressure should build from 85 to 100 psi within 45 seconds in dual air systems. (If the vehicle has larger than minimum air tanks, the buildup time can be longer and still be safe. Check the manufacturer’s specifications.) In single air systems (pre-1975), typical requirements are pressure build-up from 50 to 90 psi within 3 minutes with the engine at an idle speed of 600-900 rpms. If air pressure does not build up fast enough, your pressure may drop too low during driving, requiring an emergency stop. Don’t drive until you get the problem fixed.

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Test Air Leakage Rate. With a fully-charged air system (typically 125 psi), turn off the engine, release the parking brake (push in); and time the air pressure drop. The loss rate should be less than two psi in one minute for single vehicles and less than three psi in one minute for combination vehicles.

With the air pressure built up to governor cutoff (120 – 140 psi), shut off the engine, chock your wheels (if necessary), release the parking brake (all vehicles), and the tractor protection valve (combination vehicle); and fully apply the foot brake. Hold the foot brake for one minute. Check the air gauge to see if the air pressure drops more than three pounds in one minute (single vehicle) or four pounds in one minute (combination vehicle). If the air pressure falls more than three psi in one minute for single vehicles (more than four psi for combination vehicles), the air loss rate is too much. Check for air leaks and fix before driving the vehicle. Otherwise, you could lose your brakes while driving.

Check Air Compressor Governor Cut-in and Cut-out Pressures. Pumping by the air compressor should start at about 100 psi and stop at about 125 psi. (Check manufacturer’s specifications.) Run the engine at a fast idle. The air governor should cut-out the air compressor at about the manufacturer’s specified pressure. The air pressure shown by your gauge(s) will stop rising. With the engine idling, step on and off the brake to reduce the air tank pressure. The compressor should cut-in at about the manufacturer’s specified cut-in pressure. The pressure should begin to rise.

If the air governor does not work as described above, it may need to be fixed. A governor that does not work properly may not keep enough air pressure for safe driving.

Test Parking Brake. Stop the vehicle, put the parking brake on, and gently pull against it in a low gear to test that the parking brake will hold.

Test Service Brakes. Wait for normal air pressure, release the parking brake, move the vehicle forward slowly (about five mph), and apply the brakes firmly using the brake pedal. Note any vehicle “pulling” to one side, unusual feel, or delayed stopping action.

This test may show you problems, which you otherwise wouldn’t know about until you needed the brakes on the road.

Subsections 5.2 and 5.3

Test Your Knowledge

1. What is a dual air brake system?
2. What are the slack adjusters?
3. How can you check slack adjusters?
4. How can you test the low pressure warning signal?
5. How can you check that the spring brakes come on automatically?
6. What are the maximum leakage rates?

These questions may be on your test. If you can’t answer them all, re-read subsections 5.2 and 5.3.
5.4 – Using Air Brakes

5.4.1 – Normal Stops

Push the brake pedal down. Control the pressure so the vehicle comes to a smooth, safe stop. If you have a manual transmission, don’t push the clutch in until the engine rpm is down close to idle. When stopped, select a starting gear.

5.4.2 – Braking with Antilock Brakes

When you brake hard on slippery surfaces in a vehicle without ABS, your wheels may lock up. When your steering wheels lock up, you lose steering control. When your other wheels lock up, you may skid, jackknife, or even spin the vehicle.

ABS helps you avoid wheel lock up. The computer senses impending lockup, reduces the braking pressure to a safe level, and you maintain control. You may or may not be able to stop faster with ABS, but you should be able to steer around an obstacle while braking, and avoid skids caused by over braking.

Having ABS on only the tractor, only the trailer, or even on only one axle, still gives you more control over the vehicle during braking. Brake normally.

When only the tractor has ABS, you should be able to maintain steering control, and there is less chance of jackknifing. But, keep your eye on the trailer and let up on the brakes (if you can safely do so) if it begins to swing out.

When only the trailer has ABS, the trailer is less likely to swing out, but if you lose steering control or start a tractor jackknife, let up on the brakes (if you can safely do so) until you gain control.

When you drive a tractor-trailer combination with ABS, you should brake as you always have. In other words:

Use only the braking force necessary to stop safely and stay in control.

Brake the same way, regardless of whether you have ABS on the tractor, the trailer, or both.

As you slow down, monitor your tractor and trailer and back off the brakes (if it is safe to do so) to stay in control.

There is only one exception to this procedure, if you always drive a straight truck or combination with working ABS on all axles, in an emergency stop, you can fully apply the brakes.

Without ABS, you still have normal brake functions. Drive and brake as you always have.

Remember, if your ABS malfunctions, you still have regular brakes. Drive normally, but get the system serviced soon.

5.4.3 – Emergency Stops

If somebody suddenly pulls out in front of you, your natural response is to hit the brakes. This is a good response if there’s enough distance to stop, and you use the brakes correctly.

You should brake in a way that will keep your vehicle in a straight line and allow you to turn if it becomes necessary. You can use the “controlled braking” method or the “stab braking” method.

**Controlled Braking.** With this method, you apply the brakes as hard as you can without locking the wheels. Keep steering wheel movements very small while doing this. If you need to make a larger steering adjustment or if the wheels lock, release the brakes. Re-apply the brakes as soon as you can.

**Stab Braking.** Apply your brakes all the way. Release brakes when wheels lock up. As soon as the wheels start rolling, apply the brakes fully again. (It can take up to one second for the wheels to start rolling after you release the brakes. If you re-apply the brakes before the wheels start rolling, the vehicle won’t straighten out.)

5.4.4 – Stopping Distance

Stopping distance was described in Section 2 under “Speed and Stopping Distance.” With air brakes there is an added delay - “Brake Lag”. This is the time required for the brakes to work after the brake pedal is pushed. With hydraulic brakes (used on cars and light/medium trucks), the brakes work instantly. However, with air brakes, it takes a little time (one half second or more) for the air to flow through the lines to the brakes. Thus, the total stopping distance for vehicles with air brake systems is made up of four different factors.

Perception Distance + Reaction Distance + Brake Lag Distance + Braking Distance = Total Stopping Distance.

The air brake lag distance at 55 mph on dry pavement adds about 32 feet. So at 55 mph for an average driver under good traction and brake conditions, the total stopping distance is over 450 feet. See Figure 5.6.

### Stopping Distance

![Stopping Distance Chart](Figure 5.6)
5.4.5 – Brake Fading or Failure
Brakes are designed so brake shoes or pads rub against the brake drum or disks to slow the vehicle. Braking creates heat, but brakes are designed to take a lot of heat. However, brakes can fade or fail from excessive heat caused by using them too much and not relying on the engine braking effect.

Excessive use of the service brakes results in overheating and leads to brake fade. Brake fade results from excessive heat causing chemical changes in the brake lining, which reduce friction, and also causing expansion of the brake drums. As the overheated drums expand, the brake shoes and linings have to move farther to contact the drums, and the force of this contact is reduced. Continued overuse may increase brake fade until the vehicle cannot be slowed down or stopped.

Brake fade is also affected by adjustment. To safely control a vehicle, every brake must do its share of the work. Brakes out of adjustment will stop doing their share before those that are in adjustment. The other brakes can then overheat and fade, and there will not be enough braking available to control the vehicle(s). Brakes can get out of adjustment quickly, especially when they are hot. Therefore, check brake adjustment often.

5.4.6 – Proper Braking Technique
Remember, the use of brakes on a long and/or steep downgrade is only a supplement to the braking effect of the engine. Once the vehicle is in the proper low gear, the following is the proper braking technique:

Apply the brakes just hard enough to feel a definite slowdown.
When your speed has been reduced to approximately five mph below your “safe” speed, release the brakes. (This application should last for about three seconds.)
When your speed has increased to your “safe” speed, repeat steps 1 and 2.

For example, if your “safe” speed is 40 mph, you would not apply the brakes until your speed reaches 40 mph. You now apply the brakes hard enough to gradually reduce your speed to 35 mph and then release the brakes. Repeat this as often as necessary until you have reached the end of the downgrade.

5.4.7 – Low Air Pressure
If the low air pressure warning comes on, stop and safely park your vehicle as soon as possible. There might be an air leak in the system. Controlled braking is possible only while enough air remains in the air tanks. The spring brakes will come on when the air pressure drops into the range of 20 to 45 psi. A heavily loaded vehicle will take a long distance to stop because the spring brakes do not work on all axles. Lightly loaded vehicles or vehicles on slippery roads may skid out of control when the spring brakes come on. It is much safer to stop while there is enough air in the tanks to use the foot brakes.

5.4.8 – Parking Brakes
Any time you park, use the parking brakes, except as noted below. Pull the parking brake control knob out to apply the parking brakes, push it in to release. The control will be a yellow, diamond-shaped knob labeled “parking brakes” on newer vehicles. On older vehicles, it may be a round blue knob or some other shape (including a lever that swings from side to side or up and down).

Don’t use the parking brakes if the brakes are very hot (from just having come down a steep grade), or if the brakes are very wet in freezing temperatures. If they are used while they are very hot, they can be damaged by the heat. If they are used in freezing temperatures when the brakes are very wet, they can freeze so the vehicle cannot move. Use wheel chocks on a level surface to hold the vehicle. Let hot brakes cool before using the parking brakes. If the brakes are wet, use the brakes lightly while driving in a low gear to heat and dry them.

If your vehicle does not have automatic air tank drains, drain your air tanks at the end of each working day to remove moisture and oil. Otherwise, the brakes could fail.

Never leave your vehicle unattended without applying the parking brakes or chocking the wheels. Your vehicle might roll away and cause injury and damage.

Subsections 5.4
Test Your Knowledge
1. Why should you be in the proper gear before starting down a hill?
2. What factors can cause brakes to fade or fail?
3. The use of brakes on a long, steep downgrade is only a supplement to the braking effect of the engine. True or False?
4. If you are away from your vehicle only a short time, you do not need to use the parking brake. True or False?
5. How often should you drain air tanks?
6. How should you brake when you drive a tractor-trailer combination with ABS?
7. You still have normal brake functions if your ABS is not working. True or False?

These questions may be on your test. If you can’t answer them all, re-read subsection 5.4.
Section 8
Tank Vehicles

This Section Covers

- Inspecting Tank Vehicles
- Driving Tank Vehicles
- Safe Driving Rules

This section has information needed to pass the CDL knowledge test for driving a tank vehicle. (You should also study Sections 2, 5, 6, and 9). A tank endorsement is required for certain vehicles that transport liquids or gases. The liquid or gas does not have to be a hazardous material. A tank endorsement is required if your vehicle needs a Class A or B CDL and you want to haul a liquid or liquid gas in a tank or tanks having an individual rated capacity of more than 119 gallons and an aggregate rated capacity of 1000 gallons or more that is either permanently or temporarily attached to the vehicle or the chassis. A tank endorsement is also required for Class C vehicles when the vehicle is used to transport hazardous materials in liquid or gas form in the above described rated tanks.

Before loading, unloading, or driving a tanker, inspect the vehicle. This makes sure that the vehicle is safe to carry the liquid or gas and is safe to drive.

8.1 – Inspecting Tank Vehicles

Tank vehicles have special items that you need to check. Tank vehicles come in many types and sizes. You need to check the vehicle’s operator manual to make sure you know how to inspect your tank vehicle.

8.1.1 – Leaks

On all tank vehicles, the most important item to check for is leaks. Check under and around the vehicle for signs of any leaking. Don’t carry liquids or gases in a leaking tank. To do so is a crime. You will be cited and prevented from driving further. You may also be liable for the clean-up of any spill.
In general, check the following:

- Check the tank’s body or shell for dents or leaks. Check the intake, discharge, and cut-off valves.
- Make sure the valves are in the correct position before loading, unloading, or moving the vehicle.
- Check pipes, connections, and hoses for leaks, especially around joints.
- Check manhole covers and vents. Make sure the covers have gaskets and they close correctly. Keep the vents clear so they work correctly.

8.1.2 – Check Special Purpose Equipment

If your vehicle has any of the following equipment, make sure it works:
- Vapor recovery kits.
- Grounding and bonding cables.
- Emergency shut-off systems.
- Built in fire extinguisher.
- Never drive a tank vehicle with open valves or manhole covers.

8.1.3 – Special Equipment

Check the emergency equipment required for your vehicle. Find out what equipment you’re required to carry and make sure you have it (and it works).

8.2 – Driving Tank Vehicles

Hauling liquids in tanks requires special skills because of the high center of gravity and liquid movement. See Figure 8.1.
8.2.1 – High Center of Gravity

High center of gravity means that much of the load’s weight is carried high up off the road. This makes the vehicle top-heavy and easy to roll over. Liquid tankers are especially easy to roll over. Tests have shown that tankers can turn over at the speed limits posted for curves. Take highway curves and on ramp/off ramp curves well below the posted speeds.

8.2.2 – Danger of Surge

Liquid surge results from movement of the liquid in partially filled tanks. This movement can have bad effects on handling. For example, when coming to a stop, the liquid will surge back and forth. When the wave hits the end of the tank, it tends to push the truck in the direction the wave is moving. If the truck is on a slippery surface such as ice, the wave can shove a stopped truck out into an intersection. The driver of a liquid tanker must be very familiar with the handling of the vehicle.

8.2.3 – Bulkheads

Some liquid tanks are divided into several smaller tanks by bulkheads. When loading and unloading the smaller tanks, the driver must pay attention to weight distribution. Don’t put too much weight on the front or rear of the vehicle.

8.2.4 – Baffled Tanks

Baffled liquid tanks have bulkheads in them with holes that let the liquid flow through. The baffles help to control the forward and backward liquid surge. Side-to-side surge can still occur. This can cause a roll over.

8.2.5 – Un-baffled Tanks

Un-baffled liquid tankers (sometimes called “smooth bore” tanks) have nothing inside to slow down the flow of the liquid. Therefore, forward-and-back surge is very strong. Un-baffled tanks are usually those that transport food products (milk, for example). (Sanitation regulations forbid the use of baffles because of the difficulty in cleaning the inside of the tank.) Be extremely cautious (slow and careful) in driving smooth bore tanks, especially when starting and stopping.

8.2.6 – Outage

Never load a cargo tank totally full. Liquids expand as they warm and you must leave room for the expanding liquid. This is called “outage.” Since different liquids expand by different amounts, they require different amounts of outage. You must know the outage requirement when hauling liquids in bulk.

8.2.7 – How Much to Load?

A full tank of dense liquid (such as some acids) may exceed legal weight limits. For that reason, you may often only partially fill tanks with heavy liquids. The amount of liquid to load into a tank depends on:

- The amount the liquid will expand in transit.
- The weight of the liquid.
- Legal weight limits.

8.3 – Safe Driving Rules

In order to drive tank vehicles safely, you must remember to follow all the safe driving rules. A few of these rules are:

8.3.1 – Drive Smoothly

Because of the high center of gravity and the surge of the liquid, you must start, slow down, and stop very smoothly. Also, make smooth turns and lane changes.

8.3.2 – Controlling Surge

Keep a steady pressure on the brakes. Do not release too soon when coming to a stop. Brake far in advance of a stop and increase your following distance.

If you must make a quick stop to avoid a crash, use controlled or stab braking. If you do not remember how to stop using these methods, review subsection 2.17.2. Also, remember that if you steer quickly while braking, your vehicle may roll over.

8.3.3 – Curves

Slow down before curves, then accelerate slightly through the curve. The posted speed for a curve may be too fast for a tank vehicle.

8.3.4 – Stopping Distance

Keep in mind how much space you need to stop your vehicle. Remember that wet roads double the normal stopping distance. Empty tank vehicles may take longer to stop than full ones.

8.3.5 – Skids

Don’t over steer, over accelerate, or over brake. If you do, your vehicle may skid. On tank trailers, if your drive wheels or trailer wheels begin to skid, your vehicle may jackknife. When any vehicle starts to skid, you must take action to restore traction to the wheels.
Section 8

Test Your Knowledge

1. How are bulkheads different than baffles?
2. Should a tank vehicle take curves, on ramps, or off ramps at the posted speed limits?
3. How are smooth bore tankers different to drive than those with baffles?
4. What three things determine how much liquid you can load?
5. What is outage?
6. How can you help control surge?
7. What two reasons make special care necessary when driving tank vehicles?

These questions may be on the test. If you can’t answer them all, re-read Section 8.
ENGINEER’S FORMULA REFERENCE

<table>
<thead>
<tr>
<th>FL = FRICTION LOSS</th>
<th>C = FRICTION LOSS COEFFICIENT</th>
<th>Q = FLOW RATE IN HUNDREDS OF GAL.</th>
</tr>
</thead>
<tbody>
<tr>
<td>L = HOSE LENGTH IN HUNDREDS OF FEET</td>
<td>NP = NOZZLE PRESSURE</td>
<td>APL = APPLIANCE LOSS</td>
</tr>
<tr>
<td>EL = ELEVATION LOSS</td>
<td>EP = ENGINE PRESSURE</td>
<td>PDP = PUMP DISCHARGE PRESSURE</td>
</tr>
<tr>
<td>ROT = RULE OF THUMB</td>
<td>d = DIAMETER</td>
<td>² = SQUARED MULTIPLY A NUMBER BY ITSELF</td>
</tr>
<tr>
<td>GPM = GALLONS PER MINUTE</td>
<td>VOLUME = PARALLEL PRESSURE = SERIES</td>
<td>NR = NOZZLE REACTION</td>
</tr>
</tbody>
</table>

30 x d² x NP = GPM

<table>
<thead>
<tr>
<th>HOSE LENGTH = L</th>
<th>GPM = Q</th>
<th>NR = 1.57 x d² x NP</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 = 7.07 or 7</td>
<td>75 = 8.6</td>
<td>80 = 8.9 or 9</td>
</tr>
<tr>
<td>100 = 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the formula and table below to calculate friction loss in different sizes of hose

\[
CQ^2L = FL/100'
\]

Use the formula and table below to calculate friction loss in different sizes of hose

<table>
<thead>
<tr>
<th>C</th>
<th>1”</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1-3/4”</td>
<td>15.5</td>
</tr>
<tr>
<td>C</td>
<td>2-1/2”</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>3”</td>
<td>0.8</td>
</tr>
</tbody>
</table>

EXAMPLE: 300’ of 1-3/4” hoseline with a 200 gpm nozzle.

C = 15.5
Q = 2
L = 3

\[
FL = CQ^2L = (15.5)(2)^2(3) = 186
\]

FL = 2Q² + Q x 4 x L
FL = (2)(2)² + 2 x 4 x 3
FL = 120

To convert fractions to decimals, divide the bottom number into the top number.

<table>
<thead>
<tr>
<th>APPLIANCE(S)</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRESNAN(S)</td>
<td>3/5</td>
</tr>
<tr>
<td>SIAMESE / WYE</td>
<td>5</td>
</tr>
<tr>
<td>MULTIVERSAL</td>
<td>10</td>
</tr>
<tr>
<td>DECK GUN</td>
<td>10</td>
</tr>
<tr>
<td>LADDER PIPE</td>
<td>15</td>
</tr>
<tr>
<td>STANDPIPE</td>
<td>25</td>
</tr>
</tbody>
</table>
Section E

Denver Fire Department
Friction Loss Pump Chart
### 1-3/4" HOSE
<table>
<thead>
<tr>
<th>Nozzle Type</th>
<th>TIP SIZE</th>
<th>GPM</th>
<th>FL/100'</th>
<th>NP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth Bore</td>
<td>15/16&quot;</td>
<td>185</td>
<td>53</td>
<td>50</td>
</tr>
<tr>
<td>COMBINATION</td>
<td>N/A</td>
<td>175</td>
<td>47</td>
<td>75</td>
</tr>
<tr>
<td>FOG</td>
<td>N/A</td>
<td>185</td>
<td>53</td>
<td>75</td>
</tr>
<tr>
<td>1-1/2&quot; BRESNAN</td>
<td>N/A</td>
<td>96</td>
<td>16</td>
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### 2-1/2" HOSE
<table>
<thead>
<tr>
<th>NOZZLE TYPE</th>
<th>TIP SIZE</th>
<th>GPM</th>
<th>FL/100'</th>
<th>NP</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMOOTH BORE</td>
<td>1&quot;</td>
<td>210</td>
<td>9</td>
<td>50</td>
</tr>
<tr>
<td>SOLID STREAM</td>
<td>1-1/8&quot;</td>
<td>266</td>
<td>14</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>1-1/4&quot;</td>
<td>328</td>
<td>21</td>
<td>50</td>
</tr>
<tr>
<td>COMBINATION</td>
<td>N/A</td>
<td>250</td>
<td>13</td>
<td>100</td>
</tr>
<tr>
<td>FOG</td>
<td>N/A</td>
<td>250</td>
<td>13</td>
<td>75</td>
</tr>
<tr>
<td>N/A</td>
<td>300</td>
<td>18</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>2-1/2&quot; BRESNAN</td>
<td>N/A</td>
<td>280</td>
<td>18</td>
<td>100</td>
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### 2-1/2" LIGHT WEIGHT HOSE
<table>
<thead>
<tr>
<th>NOZZLE TYPE</th>
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<th>GPM</th>
<th>FL/100'</th>
<th>NP</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMOOTH BORE</td>
<td>1 1/8&quot;</td>
<td>266</td>
<td>14</td>
<td>50</td>
</tr>
<tr>
<td>SOLID STREAM</td>
<td>1 1/4&quot;</td>
<td>310</td>
<td>17</td>
<td>50</td>
</tr>
<tr>
<td>COMBINATION FOG</td>
<td>N/A</td>
<td>250</td>
<td>11</td>
<td>75</td>
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### 2" LIGHT WEIGHT GREEN HOSE
<table>
<thead>
<tr>
<th>NOZZLE TYPE</th>
<th>TIP SIZE</th>
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<th>FL/100'</th>
<th>NP</th>
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</thead>
<tbody>
<tr>
<td>SMOOTH BORE</td>
<td>1&quot;</td>
<td>210</td>
<td>31</td>
<td>50</td>
</tr>
<tr>
<td>COMBINATION FOG</td>
<td>N/A</td>
<td>185</td>
<td>24</td>
<td>75</td>
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</tbody>
</table>

### MASTER STREAMS

<table>
<thead>
<tr>
<th>NOZZLE SIZE</th>
<th>GPM</th>
<th>NP</th>
<th>FL/100' MULTIPLE LINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONE 2-1/2&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TWO 2 1/2&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONE 3&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TWO 3&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TIP SIZE</th>
<th>ONE 2-1/2&quot;</th>
<th>TWO 2 1/2&quot;</th>
<th>ONE 3&quot;</th>
<th>TWO 3&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/8&quot;</td>
<td>502</td>
<td>80</td>
<td>55</td>
<td>15</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>598</td>
<td>80</td>
<td>78</td>
<td>21</td>
</tr>
<tr>
<td>1-3/4&quot;</td>
<td>814</td>
<td>80</td>
<td>141</td>
<td>37</td>
</tr>
<tr>
<td>2&quot;</td>
<td>1062</td>
<td>80</td>
<td>236</td>
<td>62</td>
</tr>
<tr>
<td>FOG</td>
<td>500</td>
<td>100</td>
<td>55</td>
<td>15</td>
</tr>
<tr>
<td>FOG</td>
<td>1000</td>
<td>100</td>
<td>210</td>
<td>55</td>
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</table>

### APPLIANCES

<table>
<thead>
<tr>
<th>BRESNAN(S)</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>3\5</td>
<td>3</td>
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### MISCELLANEOUS

<table>
<thead>
<tr>
<th>SIAMESE/WYE</th>
<th>FL</th>
</tr>
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<tbody>
<tr>
<td>5</td>
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<table>
<thead>
<tr>
<th>MULTIVERSEAL</th>
<th>FL</th>
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<tbody>
<tr>
<td>10</td>
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</table>

<table>
<thead>
<tr>
<th>DECK GUN</th>
<th>FL</th>
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<tbody>
<tr>
<td>10</td>
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</tbody>
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<table>
<thead>
<tr>
<th>PRE PIPED LADDER</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRE PIPED TOWER</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIAMESE/LADDER PIPE</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>10\5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STANDPIPE</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELEVATION/FEET</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELEVATION/FLOOR</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

- SPRINKLER SYSTEM: 150 PSI PUMP IN "VOLUME"
- RELAY PUMPING: SUPPLY ENGINE IN "VOLUME"
- RECEIVING ENGINE 20-80 PSI INTAKE PRESSURE
- TRANSFER VALVE; WHEN TO CHANGE OVER
- GREATER THAN 70% CAPACITY: PUMP IN "VOLUME"
- LESS THAN 70% CAPACITY: PUMP IN "PRESSURE"
- FOAM OPERATIONS: 200 PSI AT THE EDUCTOR, 300' MAX 1-3/4" FROM THE EDUCTOR, 125 GPM FOG

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Section F

Denver Fire Department Rig Maintenance Protocol
DENVER FIRE DEPARTMENT

Rig Maintenance Protocol
This apparatus inspection must be performed **daily**, preferably at the start of each shift, by the regular or acting Engineer. It is his or her responsibility to insure that the rig is safe and mechanically capable to respond to an emergency.

Emergency apparatus use brakes, suspensions, and engines to their capacities. The smallest broken component or slightest maladjustment has the potential to severely and negatively affect the performance of the apparatus. It is, therefore, imperative that all components be thoroughly inspected on a daily basis in order to maximize the safety of the mechanical operation of the apparatus.

Engineers and acting Engineers do not need to be mechanics, but they must have the mechanical ability to:

- Identify all the major mechanical components of a rig (i.e., compressor, pumps, brake canisters, etc.)
- Be able to explain in general terms the function and importance of these components
- Learn when a component is, or may be, malfunctioning

Engineers: Develop a routine to your inspection, so that none of the items on the checklist are overlooked. A suggested method is:

- Begin by approaching the rig. Using all your senses, note anything irregular about the outside of the rig.
- Next, go directly to the engine compartment, and perform the necessary checks.
- Next, check items in the cab of the rig.
- Next, check the underside of the rig.
- Last, check the basket and all compartments for condition of tools, electrical connections, lighting and compartments themselves

**Know your rig** - For safety and efficiency, the Engineer or acting Engineer must determine if something has changed significantly since the apparatus was last inspected. Every rig is different, so the Engineer must know the peculiarities of his or her rig. If, for example, the coolant in the radiator is significantly lower than it was for the previous check, then something is abnormal. It is then the Engineer's duty to do something about it!

In this booklet, each required inspection item is followed by an explanation (typed in italics) of its importance to the overall functioning of the apparatus.

This manual is based on the D.O.T. 56-point inspection and on recommendations of the Denver Fire Department Repair Shop.
1 APPROACHING THE APPARATUS

As you approach the rig, use all of your senses to detect any irregularities. Smell for unusual odors (antifreeze, oil, fuel, etc.); listen for air leaks or dripping fluids; look for puddles, loose pieces or wires, apparatus listing to one side, etc; feel on the underside of components for fluid leaks or unusual features.

When you get to the rig, do a complete walk-around, making sure that all compartment doors are secure, all glass, mirrors and lights are in tact, and tire inflation and condition appear normal.

Get to know your particular rig and note anything that is unusual for it. Call the shop for advice about anything you are unsure of.

From here, proceed to the engine compartment. Fluid levels must all be checked before starting the engine. This area is the "heart" of the machine; if something is wrong here, it could be detrimental to apparatus operation.

2 CHECK ALL FLUID LEVELS

Engine oil - The oil level must read between the "refill" mark ("L") and the "full" mark ("H"), in the safe operating range (fig. 1). Adequate lubrication extends engine life and prevents engine failure due to seizure.

Note: Some older rigs have two sets of oil marks; one for engine running (Marked "HIR" or "LIR"), and one for engine stopped (Marked "H" or "L"). Be sure to use the correct set of oil level marks to determine oil level.

Coolant - Engine coolant is critical to efficient engine operation, and it must be checked on a daily basis. Do not check the coolant level when the engine is hot.

Coolant level should be within two inches of the bottom of the filler neck (fig. 2). The sight glass (fig. 3) is not an accurate method to check coolant level.

As the system ages, the glass becomes contaminated, giving inaccurate readings. Inspect all cooling system hoses for leaks, checking for fraying, cracking, and for tightness of clamps. Check the radiator for leakage.

This step is critical, and must be performed daily. Adequate coolant prevents engine failure due to overheating in hot weather or freezing in cold weather.

The single leading cause of engine failure is insufficient coolant in the cooling system. All components of the coolant system that could cause a leak must be carefully checked.

Diesel engines self-destruct very quickly if coolant level is too low. Currently, the cost to rebuild an engine is in excess of $15,000 and requires up to 90 days to repair.
**Power Steering** With the engine stopped, check the power steering fluid reservoir dipstick for fluid level. The level must be above the refill mark. Do not overfill. Adequate fluid level and a secure belt prevent hard steering and possible loss of vehicle control.

**Transmission**

Fluid - Fluid levels in the transmission need not be checked on a daily basis unless there is evidence of a leak of red transmission fluid.

Contact the shop if you cannot determine the proper replacement fluid (power steering, transmission, oil or coolant). Not all rigs require the engine same fluids. The shop has tried to identify proper fluid replacement tags on the rig.

3 **CHECK THE ALTERNATOR AND BELT**

Identify the alternator belt and press it to see that it is snug. Check to see that the belt is not frayed and has no visible cracks, loose fibers, or signs of wear.

Push the belt with your hand. If it deflects more than 3/4 of an inch, slippage is probably excessive, and a tensioning adjustment is needed. Check for any loose or frayed wires near the alternator. Shake the alternator to make sure it is tight in its mountings.

4 **AIR COMPRESSOR**

When checking the air compressor, look for obvious signs of water, air or oil leakage (compressors are water-cooled). Check all incoming and outgoing water and air lines for leaks. The air compressor maintains air pressure in the air brake system. Loss of air supply can result in sudden application of spring brakes, leading to loss of vehicle control. In the case of low air pressure, the brakes may drag and overheat. Water leakage can lead to engine destruction.

5 **FAN BELT CONDITION**

Check all fan belts for fraying. Check for tightness by depressing midway between pulleys. If they deflect more than 3/4", a tensioning adjustment is needed.
6 CHECK ALL GAUGES

Gauges are remote indicators that show normal or abnormal engine operating parameters. Know your rig; use the gauges to try to spot anything that is abnormal for the apparatus.

Prior to starting the engine, turn the ignition on (all lights and accessories off) and the battery switch to battery #1. If the rig has a volt meter, get a reading of the battery condition. It should read about 12 volts. Notify the shop if the reading is less than 11 volts. Repeat the procedure for battery #2. If the rig has an ammeter, it will not register a reading until the engine is running.

Check the air pressure gauge and note any pressure loss since the engine was last run. The maximum allowable overnight air pressure drop is a loss of 80 psi in 8 hours. Maximum pressure should not exceed 120 psi. (plus or minus 5 psi.). Check all other gauges for abnormal readings.

Turn the battery switch to "both," and start the engine.

Oil pressure gauge. Immediately check the oil pressure gauge to ensure that the oil pressure is building to normal. If the engine is hot, pressure may indicate low – this is not unusual. The gauge will show increasing or normal oil pressure, and the warning light will go out. The oil pressure check will ensure that the engine has sufficient lubrication to prevent engine failure or breakdown.

Voltmeter or ammeter. A voltmeter, which measures the voltage in the system, will have the word "volts" on the gauge. An amp gauge, which measures whether or not the alternator is putting out a charge, will have the word "charge" or "discharge" (numbers may not be displayed). These gauges are meant to function only as a reference, so even if they do not accurately read actual system values, they are still vital for determining charging system operation.

When the engine is first started, the ammeter needle will jump and flutter, then indicate a charge. Some engines need to be revved to 800 rpm for the meter to start indicating. Electrical demand of modern lighting is excessive, so with all emergency lights on and the engine at an idle, it is normal for this gauge to show a discharge.

The voltmeter, or ammeter, indicates whether or not the alternator is functioning. The voltmeter check ensures that the electrical system is performing properly and will power headlights, turn signals, stop lights and emergency warning devices.

Water temperature gauge. Check to see that the water temperature is within the normal operating range.

Fuel gauge. Make sure there is enough fuel in the tank for a normal day's activities. Do not allow fuel level to go below 1/2 tank.

7 LIGHTS

Check that all dashboard indicator lights for turn signals, Sway flashers, and high and low beams are working. Next, check all exterior lights: clearance, tail, brake, stop, Sway flashers, headlight high and low beams, turn signals front and rear, and emergency lighting.

8 MIRRORS

Check all mirrors for proper adjustment. Check to see that all internal and external mirror(s) and mirror bracket(s) are not damaged and are mounted securely with no loose fittings. Make sure mirrors are clean, so visibility is not impaired. Mirrors provide visibility to the sides, rear, and inside the vehicle.
9 SAFETY BELT  Check for a properly secured, mounted, and adjusted safety belt.

10 CHECK THE WINDSHIELD  Make sure it is clean and has no obstructions or damage to the glass. Cracks or dirt can cause Yolk to lose sight of other traffic or changes in road conditions.

11 CHECK THE STEERING PLAY
Maximum allowable "play" is 2" in a 20" steering wheel. To check steering wheel play, wiggle the wheel back and forth while looking out the driver's side door at the front wheel (engine running). Check to determine how much steering wheel movement is needed to make the front wheels turn. This check assesses "play" in the entire steering system. Excessive looseness causes difficulty in controlling the apparatus. It also may indicate potential problems in the steering gear and linkage.

12 CHECK THE PARKING BRAKE
Put the transmission in "Drive" and GENTLY throttle up to approximately 800 rpm, trying to pull forward with the parking brake on. Air pressure should be a minimum of 90 psi to assure maximum braking power. The vehicle should not move at all. If it does, there may be a problem with the parking brake that warrants further investigation.  
Caution: Excessive throttle application can twist off the drive shaft, causing severe damage to the apparatus underside. Also, if the parking brake is not functioning correctly, the rig may roll forward unexpectedly.

The parking brake keeps the vehicle from rolling when parked. It must function when the vehicle is parked, especially when on a grade. A rolling vehicle could cause damage or injury to other vehicles, pedestrians, or motorists.

13 CHECK THE AIR BRAKE SYSTEM
The proper procedure is as follows:
1. 90-120 psi indicated on air pressure gauge.
2. Engine stopped, gear shift in neutral, ignition on.
3. CHOCK THE WHEELS TO PREVENT VEHICLE MOVEMENT.
4. Release the parking (maxi) brake.
5. Fully apply, and hold, the foot brake.
6. Pressure drop must be less than 5 psi in 30 seconds after application of the foot brake (pressure will initially drop 5 psi per axle when pedal is applied)
7. Fan off pressure by pumping the brake pedal only until the buzzer sounds (60 psi or so).
8. Start engine and rebuild system pressure to 120 psi
10. Leave wheels chocked for next step.

Continue your inspection on the underside of the rig.
1 CHECK ALL STEERING COMPONENTS

Steering box and hoses - Check that the steering box is securely mounted and is not leaking. Look for any missing nuts, bolts, or cotter pins. Check for power steering fluid leaks or damage to power steering hoses. This mechanism transforms steering column action into wheel-turning action. Loose bolts or cracks in the steering box could result in loss of steering if the gear box or steering wheel shaft becomes partially or fully disconnected.

Check the steering linkage. It transmits steering wheel action from the steering box to the wheels.

Check that connecting links, arms, and rods from the steering box to the wheel are not worn, loose, or cracked. Check for loose or missing nuts, bolts, or cotter pins. Worn, loose, or broken steering parts drag link, pitman arm, tie rod ends, etc. can cause loss of steering action. Excessive movement in the linkage can cause serious vehicle control problems.

15 CHECK ALL SUSPENSION COMPONENTS

Check the springs. Look for missing, shifted, cracked, or broken leaf springs. Look down every spring for rust spots. This step is very important. A small amount of rust over the entire spring is normal. A crack will show as a definite line of rust, usually as a vertical line. Use a flashlight to get a good view. Note: A broken or damaged assembly clamp is NOT a hazard.

A failed spring will cause other springs to fail, and can lead to total loss of control. Springs dampen wheel vibration forces created by the apparatus rolling over the road surface. Damaged or missing leaves may lead to a loss of control or a rollover accident if the vehicle falls on the frame or on a tire. Shifted springs may strike a tire, causing a blowout or interference with steering.

Check the spring mount. This includes all brackets, bolts, and bushings used for attaching springs to the frame, and the U-bolts that attach the axle to the springs. Check that all spring mounting parts are in place. Check for cracked or broken spring hangers and for broken, missing, or loose bolts (including U-bolts). Check each axle for missing or damaged bushings and for broken, loose, or missing axle mounting parts. Lack of grease is the single most common cause of spring failure. Spring mounts must be able to rotate in their mountings to function properly if they cannot rotate due to insufficient lubrication, they will instead begin to flex abnormally, and then break. Spring mounts must be greased on a weekly basis.

Loose, worn, or broken components may lead to loss of control or a rollover.
Any broken spring is cause for immediate concern because it is unsafe. Although the rig does not have to be placed out of service immediately, the shop must be notified. The shop will decide whether or not the rig will be put out of service until it is repaired.

Grease jockeys - Must be monitored for proper operation. Dry or rusty spring mounts indicate insufficient action, or an empty supply bag. Piles of grease either at the spring mount or on the apparatus floor indicate over-greasing. Contact the repair shop for adjustments or supply bag refill if either condition exists.

16 CHECK ALL BRAKE COMPONENTS

Brake drums - Check for missing pieces or obvious defects.

Brake shoes - Visually check for obvious defects. The minimum brake lining thickness is 1/4".

Check the air brake components

• Check the canisters for physical damage. Shake the canisters to make sure they are tight in their mountings. Hand check each mounting bolt for tightness. Failure of brake canister mounting bolts is a common occurrence.

• Loss of canister mountings means loss of all braking of the affected axle, causing loss of braking power, uneven steering, and possible loss of vehicle control.

Check to see that the slack adjusters are at a 90° angle. This can be done visually. Also, check to see that the angle of the slack adjusters is at the same approximate angle for each of the brakes on each individual axle.
If they are not equal, then uneven braking will occur, possibly causing loss of vehicle control when the brakes are applied.

- Check all brake lines leading to the brake canisters for cracked, worn, chafed, or frayed hoses. Also, make sure that all couplings are secure and not leaking. In order to be done properly, this check must be conducted by two people. Have your helper fully apply the foot brake while you listen for air leaks under the rig. Listen at each wheel.

- Failure of a brake line may lead to loss of brake response or a sudden brake application that could result in wheel lockup and loss of control.

- Check the Telma unit for any broken or loose wiring. Check further by driving on the street at a speed greater than 5 m.p.h.; when the brakes are applied, four of the dash indicator lights should come on.

17 CHECK WHEELS AND TIRES

Check every tire for 1) tread depth, 2) inflation, and 3) overall condition. Tread depth is a minimum of 4/32”, 1/8” on steering axle tires, and 2/32”, 1/16” on all other tires. This is an average depth; tread wear is invariably uneven across the face of the tire, especially on the rear duals. If the tires on the front axles are not wearing approximately the same, it is a possible cause for concern. Generally, it is uncommon for front wheels to be out of alignment. Front tires often wear differently because the rig predominantly turns either right or left exiting the firehouse.

Typically, the inside tire on the duals will wear out before the outside one does. As long as at least one of the tires has adequate average tread depth, there is no need for concern. (Even tires that are bald have an additional rubber thickness of 12/32”.) However, if a tire cord is exposed, it is an immediate safety concern; notify the repair shop.

Look for cuts or other damage to the tread or sidewalls. Make sure that valve caps and stems are not missing, broken, or damaged. Check for proper inflation by using a tire gauge (kicking the tires is not an adequate check for inflation). Tire inflation pressures vary according to tire brand and size, as well as the individual apparatus. It is the responsibility of the Engineer or acting Engineer to find out proper tire inflation pressures for his rig from the repair shop. Under no circumstances should tires be allowed to run with less than 90 psi in them.
Check to see that there is no debris caught between the duals. *Low inflation or lack of tread increases the effect of hydroplaning and reduces cornering ability.* Stopping distances are extended due to poor contact with the road surface. Over-inflation increases the chance of tread separation and tire failure. Cuts and bruises may cause tire failure, blowout, and sudden loss of control. Debris thrown from between tires could strike other traffic and cause damage or injury.

**Check the lug nuts on each wheel.** Check that all lug nuts are present and tight, with no rust trails around the nuts. Also, make sure that the lug bolt holes are not distorted and do not have cracks radiating from them. *Lug nuts hold the wheel on the axle.* Loose or missing lug nuts could result in the loss of a wheel.

**Check for damaged or bent rims.** Damaged rims can result in a loss of a tire from the rim, loss of a wheel from an ax/e, loss of air pressure in a tire, or a wheel rolling off a rim due to damage to a flange. A damaged wheel can result in loss of vehicle control.

**ADDITIONAL CHECKS**

**Pump panel** - Close all bleeders, check for missing outlet caps, and open gate valves. Assure that the pressure relief valve is properly set. Check tank water level. Set tank to pump valve according to your preference. Put pumper in pump gear, and make sure you can get water. Flow a small amount of water from the reel, check the outlet gauge pressure and an "OK to pump" indicator light. Operate manual pump override to assure proper operation. Make sure rig is fire ground ready by checking all the following: controls, gauges, lights, and all pre-connects and hose-beds for proper size, condition, and amount of hose.

**Aerials** - Check operation of PTO, outriggers, and whatever else is necessary to the individual rig to assure that it is fire ground ready.
1. **GREASE SPRING SHACKLES**
   All spring shackles must be greased weekly, unless the apparatus is equipped with a grease jockey.

2. **LUBRICATE** - Lubricate all door hinges (cab and compartments). Lubricate all throttle linkage points, pins, and joints with one or two drops of oil.

3. **PUMP** - With water flowing from the pump, check operation of pump controls, panel throttle, changeover valve, and discharge gates. Flow water through all 2-1/2 inch discharge gates and operate gates several times. Lubricate the pump shaft linkage, throttle linkage, pressure relief linkage and piston, discharge gate linkages and changeover valve linkage. Pump packing should leak approximately 30 to 60 drops per minute under hydrant pressure. Mechanical type should be dry.

4. **AERIAL LADDER** - Run the ladder through a full cycle of operations: raise, extend, and rotate both left and right 360 degrees. Observe for hydraulic leaks, proper operation of all controls, ladder locks, section rollers, limit stops, parking brake control and frame jacks.
   - Apply one or two drops of oil to the control linkage pivots and pins, cable pulleys, hoisting cylinder pivots, ladder lock pivots, and bed lock pivots. Lubricate section rollers. Oil the limit control mechanism.

5. **CLEAN** - Clean all compartments and tools.

6. **AUXILIARY EQUIPMENT**
   Start and run all saws, K-1 2's, Hearst tools and fans to assure proper starting and operations. Check fuel and oil levels and spare fuel canisters.

7. **GREASE JOCKEY** - Check function of unit (do not adjust!): Rust on the spring mount points means inadequate lubrication; excess grease either dripping onto the floor or oozing out at the grease points means over-greasing. If either of these conditions exist, notify the repair shop.

8. **PRESSURE RELIEF VALVE**
   Test and operate the pressure relief valve once a week to keep valve clean and operational by using the following procedures recommended by the repair shop.
   - With the engine running:
     1. Open "Tank to Pump" valve
     2. Engage pump gear
     3. Raise pump pressure to 200 psi
     4. Turn pressure relief valve to "On," and crack the stank fill valve so that water will circulate
     5. Adjust pressure down to 150 psi (water does not need to be flowing)
     6. Cycle between 150 and 200 psi three or four times

9. **TIRE PRESSURE** - The maximum tire pressure for any rig is 110 psi, unless otherwise specified. Call the shop for tire pressures for individual rigs.
   - Excessive pressure destroys tires and rims, and has the potential to cause serious injury or loss of control.
   - Fuel-filling facilities and numerous tire service companies have the capability to efficiently fill truck tires. Call the shop for locations.
1 AIR BRAKE CHECK
Perform a full, regular air brake check, with the following addition: After fanning off brake pressure until the warning buzzer activates, continue to fan off air pressure and make sure that the spring brake activates at '25-40 psi

2 LUBRICATION
Perform a full-chassis lubrication.

3 TRANSMISSION
Check the transmission fluid level using the following procedure:
   a) Engine and transmission at full operating temperature
   b) Engine at 1000 RPM and transmission in "N"
   c) Read dipstick: Fluid level must read between the "Add and the Full" mark. If fluid level is below the Caddy mark, notify the shop.

4 BATTERIES - Clean off any corrosion and check terminals to see that they are tight. Test cells with a hydrometer. A normal reading is 12.5 specific gravity, although the reading may be as low as 8 or so if the battery is discharged. Look for inconsistent readings from cell to cell, as well as an overall reading that is very low. If one cell is significantly lower than the others, charge the battery for 24 hours and retest. A "quick-charge" will not allow the battery to sufficiently recover if it is severely discharged. If there is not significant improvement, notify the shop. Batteries are scheduled to be replaced every four years. There is a code number inscribed onto every battery. The second digit indicates the year purchased and the third digit indicates the month.

5 GREASE JOCKEY SUPPLY BAG
Gently squeeze bag to determine how much grease is left in it. If the bag is fully collapsed, it is empty; notify the repair shop.

IMPORTANT PHONE NUMBERS:

<table>
<thead>
<tr>
<th>Service</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair Shop</td>
<td>720-865-3850</td>
</tr>
<tr>
<td>Driving Instructor</td>
<td>720-865-4096</td>
</tr>
<tr>
<td>Hose Repair 15’s</td>
<td>303-370-8107</td>
</tr>
<tr>
<td>Chain Repair 25’s</td>
<td>303-937-4455</td>
</tr>
</tbody>
</table>
1 **MAXIMUM ENGINE OPERATING TEMPERATURE**

180° is normal. Maximum continuous operating temperature is 200°, but is enough of a concern to call the repair shop. If the, engine temperature exceeds 210°, it must be shut down. An exception is fire ground operation, where lives may be put in jeopardy as a consequence. You can mist the radiator with spray from the reel as a makeshift cooling method until repairs are made, or help arrives. On a run, reducing speed will often help bring engine temperatures down.

2 **AUXILIARY ENGINE COOLER**

Leave on at all times. If the auxiliary cooling system develops a leak, it may then be shut off.

3 **BATTERY CHARGER** - Every rig must be plugged into the battery charger 24 hours a day. Modern lighting packages rapidly drain batteries, and short runs do not replenish battery charge. Engines at idle do not put out enough surplus current to charge batteries, especially if all lights are operating. In addition, the radios are susceptible to voltage dropout, and will not function properly if battery voltage is low.

4 **PRESSURE RELIEF VALVE**

Keep the pressure relief valve in the OFF position when not in use, and set at 150 psi. In an emergency, it is possible to turn the pressure relief valve on and quickly reduce pressures below 150 psi. Additionally, if the valve is on and a line is inadvertently charged, it is less likely to cause injury.

5 **AERIAL LADDER LUBE**

Manufacturer's guidelines mandate a full lubrication (strip, clean, and lube) of the aerial ladder after 10 hours of operation, or if unused, a minimum of two times per year. Damage to the aerial is done while it is in the bed, as a result of road dirt.

6 **BATTERY SWITCH** - The battery switch must always be turned to “Both” whenever starting or operating the apparatus. A single battery is insufficient to adequately operate apparatus electrical systems. Under average conditions, the alternator will adequately charge both batteries.

7 **SPRING BRAKE (MAXI)** - The minimum safe system pressure to move an apparatus is 60 psi. Less than 60 psi allows the rear brakes to drag and heat up unnecessarily, in addition to preventing the front brakes from working properly.

8 **APPARATUS PARKING** - As a matter of safety, every apparatus must be kept in neutral, or the N position when parked, with the maxi brake ON, either at an incident or in the firehouse. It is a safety concern: Solenoids have been known to stick in the “on” position, even in the middle of the night, allowing unmanned apparatus to start.
**OILCHANGES** - These are no longer done in the firehouse. The oil filter change date is written on the bottom of the filter. If you notice an out-of-date filter during your check, notify the shop.

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### Daily Vehicle Check

**1. Approaching the Apparatus**
- Use senses to detect anything unusual

**2. Fluid Levels**
- Oil
- Power Steering
- Coolant: level / leaks / hoses

**3. Alternator**
- Alternator tight

**4. Air Compressor**
- Air Compressor (leaks)

**5. Fan Belts**
- Tight, not damaged

**6. Gauges**
- Before Engine Start:
  - Amp/Volt meter
- After Engine Start:
  - Air
  - Oil Pressure
  - Temp
  - Ammeter/Voltmeter
  - Fuel

**7. Lights**
- Dash Indicator Lights
- Exterior Lights
- Emergency Lighting

**8. Mirrors**
- Mirrors

**9. Safety Belt**
- Secure, adjusted

**10. Windsheild**
- Clean, no cracks

**11. Steering Wheel Play**
- 2" in a 20" wheel

**12. Parking Brake**
- Brake set, gently try to pull forward

**MISC.**
- Heater & Defroster
- Horns
- Wipers/Washers

**13. Air Brake Check**
- Air at 90 - 120 psi
- Shut off Engine
- Ignition on
- Wheels chocked
- Release Parking Brake
- Hold Footbrake (5 psi max/30 sec)
- Fan off to low air warning (80psi)
- Start engine, rebuilt pressure
- Leave wheels chocked

**14. Steering Components**
- Steering Box (leaks, missing parts, securely mounted)
- Steering Linkage (tight, not excessively worn, no parts missing): PITMAN ARM, DRAG LINK, STEERING ARM, TIE ROD END, TIE ROD, KNUCKLES

**15. Suspension Components**
- Springs: missing, broken, cracked
- Spring Mount: brackets, bolts, bushings, U-Bolts, hangers
- Spring Mount: sufficient grease

**16. Brake Components**
- Drums, Shoes
- Telma Unit
- Air Brake Components:
  - Canisters (loose, damaged)
  - Slack adjusters (90 deg, even at both ends of axle)
  - Air lines (no leaks)

**17. Tires and Wheels**
- Tires (tread depth, inflation, condition)
- Lug nuts (tightness)
- Rims (bent, damaged)

**18. Additional Checks**
- Bleeders, caps, gate valves
- Pressure Relief Valve
- Water Tank Level
- Operate pump
- Rig fireground ready
- PTO

**MISC.**
- Drive Shaft
- Exhaust System
- Frame
- Fuel Tank (leaks / lines)

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**Road Test**

<table>
<thead>
<tr>
<th>Right / Left Turn</th>
<th>Straight Line Alleyway</th>
<th>Offset Alleyway</th>
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<tbody>
<tr>
<td>Pullups</td>
<td>0 1 2 3 4 5</td>
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</tr>
<tr>
<td>Encroachments</td>
<td>0 1 2 3 4 5</td>
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<table>
<thead>
<tr>
<th>Diminishing Clearance</th>
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<table>
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<tr>
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<th>Intersection Turnaround</th>
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**Vehicle Inspection Score**

**Road Test Score**

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